AMERICAN ARTISAN

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One of the largest architectural metal replacement contracts of recent months roofs the New York Public Library with Monel metal. The original metal roof failed because of improper application methods. The mechanic is soldering sections of the new cresting.

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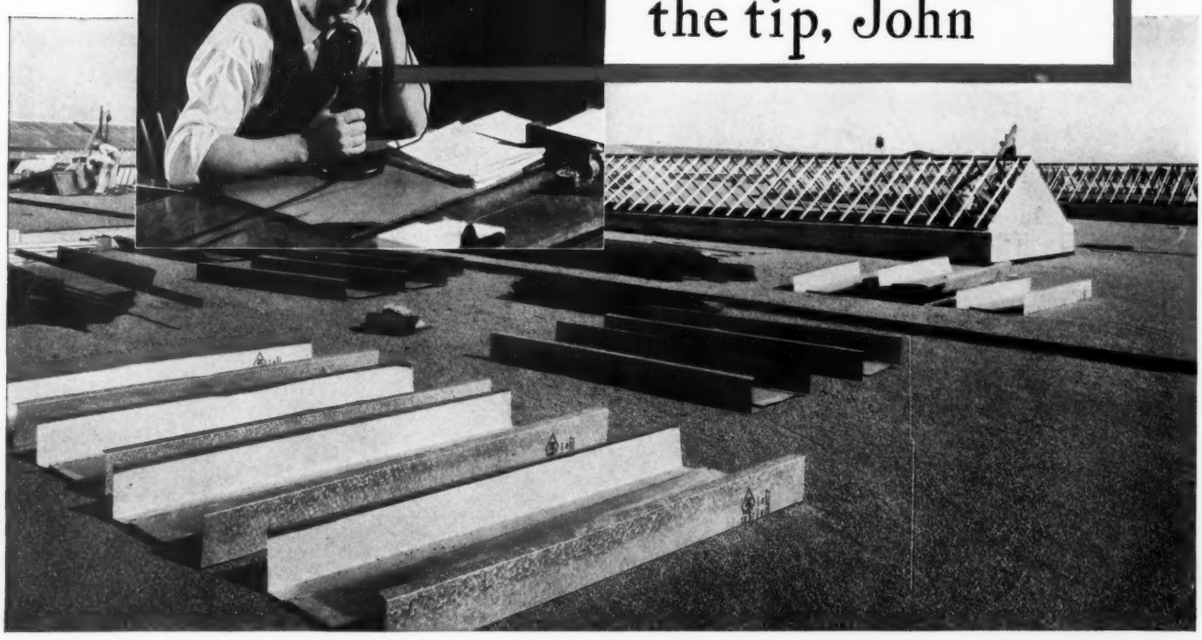
1936

THE AIR CONDITIONING SECTION

"Those Toncan Iron Sheets have saved me real money. Thanks for the tip, John"



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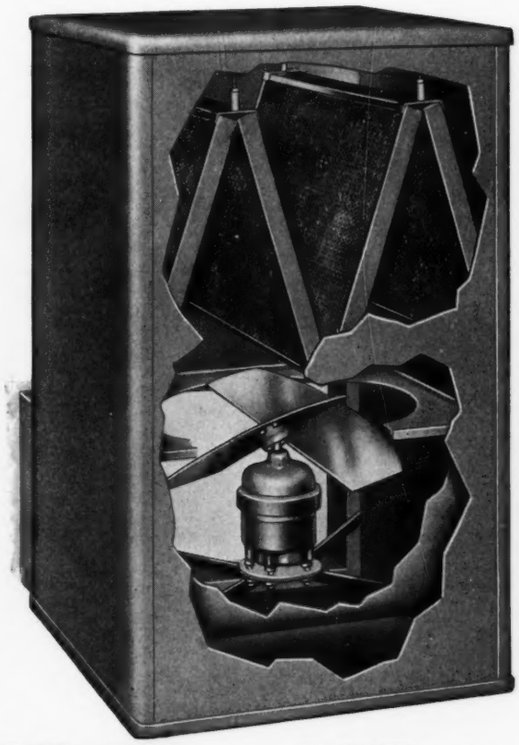

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In This Issue

Probably every reader who has been in New York City knows the public library at 42nd and Fifth Avenue. The huge building is to have a new roof. The old metal roof deteriorated because of faulty installation. Some preliminary details are related on page 12.

*

It's likely that one of two things interest most of us when we think of the Social Security act. First how much money will an employee get when out of work and secondly how much pension will all of us rate when we reach 65. Joseph G. Dingle explains how the pension is figured and how much we get in his article on page 18.

*

We conclude in this issue our publication of the Minneapolis code. We understand that as a result of publicity this splendid code has become the focal point of proposed legislation in all parts of the country. Would any readers be interested in having complete copies?

*

On page 29 is the second and concluding portion of the Research Residence report on cooling with 58-degree water from the Urbana water mains. This is probably the most authentic discussion so far reported of water cooling with water at temperatures close to the limit of use.

*

An argumentative question of the moment relates to quoting prices for duct work on a per opening basis. In Cleveland the Institute (Eugene Farris, director) has been all through the mill on this cost proposition and condemns pricing on a per opening basis. Mr. Farris explains why on page 32. Your arguments pro and con are invited.

*

In Kansas City (where it really gets hot), M. W. Pehl tested the scheme of working an attic fan and the basement blower together to effect cooling. The results he secured, together with full information on operation, are charted on page 34.

*

S. Konzo continues his presentation of design procedure on page 36. This article deals with temperature drop in ducts.

*

We conclude Professor Kratz's paper on Factors Affecting Comfort on page 42. If you think the radiator people have no problems take a look at the room temperature gradients accompanying this article.

*

And part three (conclusion) of a method for establishing the cooling load starts on page 38. Some valuable tables covering the heat output of such items as percolators, stoves, steam tables, are presented. The three parts of this paper (May, June, July) cover cooling calculations completely.

AMERICAN ARTISAN

With which is merged

FURNACES and SHEET METALS AND Warm-Air Heating

Covering All Activities in

Gravity Warm Air Heating — Forced Warm Air Heating
Sheet Metal Contracting — Ventilating
Air Conditioning

J. D. Wilder, Editor

Vol. 105, No. 7 — July, 1936 — Founded 1880

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Member of Audit Bureau of Circulations—Member Associated Business Papers, Inc.

Published monthly by Keeney Publishing Company, 6 North Michigan Ave., Chicago. Branch Offices—In New York, Room 1950, Grand Central Terminal Building, Murray Hill 2-8293; In Cleveland, 2047 Rossmoor Road, Cleveland Heights, Yellowstone 1540; In Los Angeles, J. H. Tinkham, 1406 S. Grand Ave., Richmond 6191.

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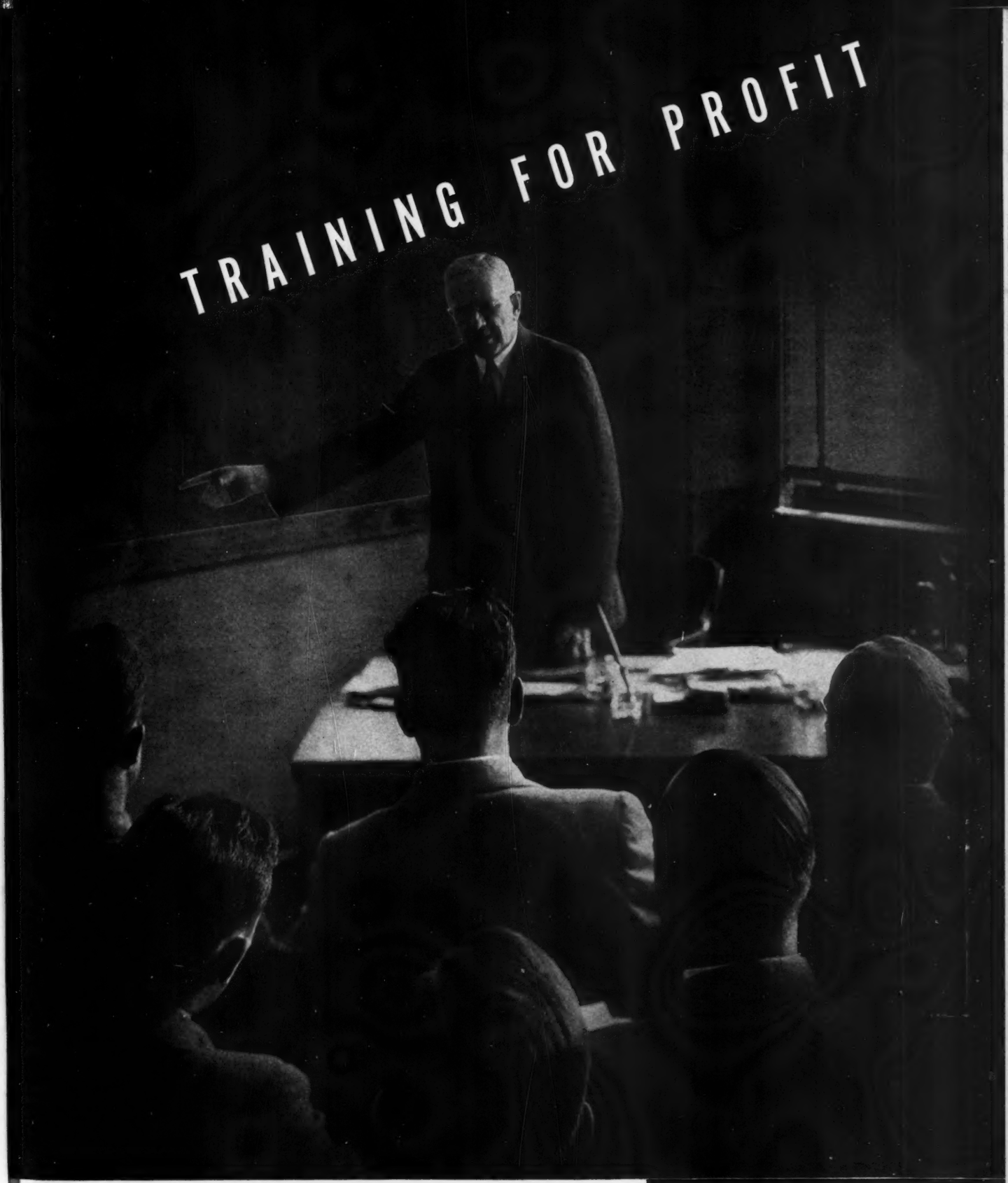
Yearly Subscription Price—U. S. and possessions, Canada, Mexico, South America, Central America, $2.00; Foreign, $4.00. Single copies, U. S. and possessions, $.25. Back numbers, $.50. January, 1936, Directory issue, $1.00 per copy. Entered as second-class matter, July 29, 1932, at the Post Office at Chicago, Illinois, under the act of March 3, 1879.

More than 7,000 Copies of this Issue are being distributed

TRAINING FOR PROFIT



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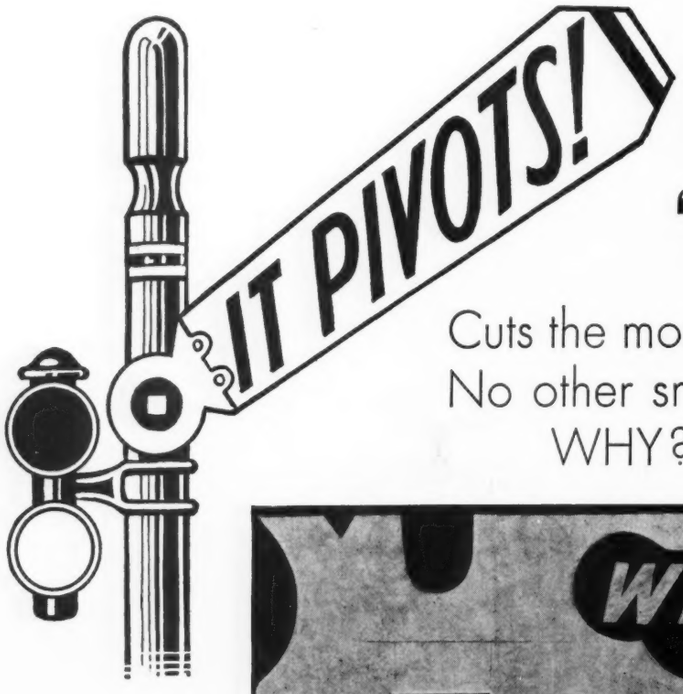

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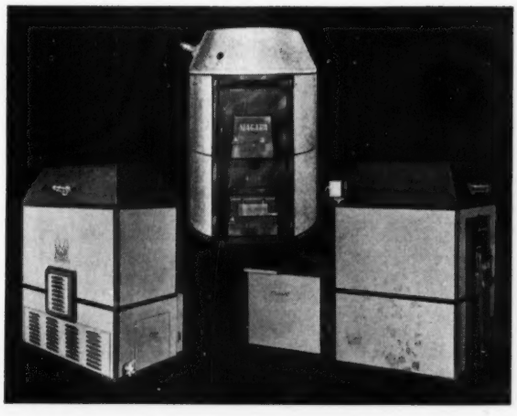

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1. ***Good Appearance.*** Copper increases in beauty with age and service.
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AMERICAN ARTISAN

Volume 105 Number 7

Behind a Button

Recently a contractor from Nebraska stopped in the office to explain his experiences and to inquire if we had any advice to offer. Briefly this man's problem is this—"Summer air conditioning is gaining momentum at a tremendous pace out our way. If prospects had more money we couldn't install all the work we would get. Two of us are doing most of the larger work. It so happens that we are friendly enough to talk over our mutual problems at least once a week.

"My competitor believes in telling the prospect that he does not need to know a thing about the mechanical, electrical, physical characteristics of cooling. He says —'Just press the button and the machine does the rest.'

"Now it so happens that I don't quite agree with this sales philosophy. My experience seems to indicate that because cooling is so new the prospect is definitely interested in what goes on 'behind the button.' I've followed this belief and attempted to romance as far as possible on the marvels of science and engineering which furnishes this 'manufactured weather.' So far as I can judge this romancing has raised my standing as an engineer in the estimation of my customers, yet I must admit that I spend more time on calls and 'build-up' than my competitor does and I'm willing to be shown that the other way gets as much business at less time and effort.

"What do you think and how would you proceed keeping in mind that the policy will likely be in force for three or four years?"

Of course our answer was that "It all depends on circumstances. Probably you can be more convincing when you romance than you would be as a cut and dried specification booster. What is successful with you may not be worth a darn to your competitor. Sell the way you like best—providing you are getting your share of the work and change your tactics when the need arises.

Nevertheless there is a very interesting point raised here.

Is there any romance to summer cooling?

Is the public interested in what goes on "behind the button" or does the public buy as they select an automobile—for style, price, "because Jones says this is a good car."

Is there any value in giving cooling a romantic aspect in order that we may be looked upon as a craft apart —as a profession which requires some exceptional knowledge, experience, training.

Does a build up of romance help to make the prospect shy away from the contractor who has no professional or business standing, but who will "guarantee his head off."

The contractor asked what we thought. We'd like to know what you think?

◆

The Trees Hide the Wood

"Can't see the wood for the trees" is an old expression frequently used to indicate that a man's perspective of his field as a whole is too often obscured by the immediate problems and exigencies. And it is human nature to feel that personal conditions and problems are "different" from the problems of others and therefore present ways of doing business are satisfactory.

If a man is making a satisfactory living and enjoying life it is difficult to convince that man that he ought to change his basis of operations in order to take advantage of changing public opinion and desire.

For example, a survey made three years ago disclosed that mechanical warm air heating had then made little impression on the home owner in the small town. Another survey made within the past few weeks disclosed that it is impossible to find a community today where mechanical warm air heating is not being sold and demanded.

The first survey also indicated that automatic firing had then made little headway whereas the recent survey showed that specialty sales agencies, coal dealers, direct selling manufacturers, plus national advertising amounting to millions of words have created such a desire for automatic firing that even the dwellers on our farms now want and buy.

Artisans in metal, replacing the old time tinner, have contributed to modern living countless items of better construction because some man learned how to work new materials. Difficult it is to find today a community without its flashy theatre or store front.

People usually "want" things long before expressing an active desire to buy. If we, as purveyors of human comfort and protection, are content to exist without change, this public hankering for new things is circumvented.

On the other hand if we do not let "the trees hide the wood" and bestir ourselves to be first to offer new things to the public we will progress toward a higher community standing and greater profit.

World's Second Largest Library Uses 80 Tons of Metal for Its New Roof

By R. C. Nason

Faulty workmanship caused the metal roof on the New York Public library to fail. The metal itself was in good condition, but seams opened admitting water. The new roof is of copper-nickel metal (Monel) and the application methods are the last word in weather resistance.

A VERY interesting metal roofing project is underway in New York City where the famous Astor Public Library at 42nd Street and Fifth Avenue is having its sheet metal roof, laid 27 years ago removed and replaced with another metal roof of 24-gauge nickel-copper metal. The new covering, calling for 80 tons of sheet, some 100,000 linear feet of new battens, new cresting and ornaments and other features that mark modern roofing, makes this work of unusual importance at this time.

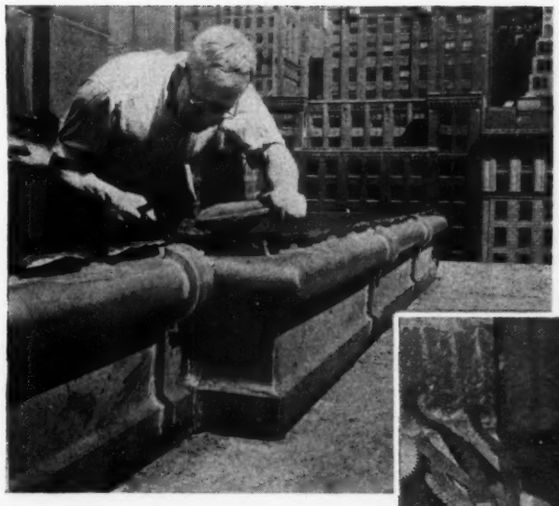
The library roof in its general shape, is quadrangular. Although flat on the Fifth Avenue side, the other roof sides are pitched, with the largest area facing Bryant Park at the rear of the building. Due to the simple roof lines thus offered, no complex problems faced the sheet metal engineers and mechanics. Certain changes in work style, on the other hand, regarded as improvements, lend interest.

One feature has to do with the shape of the battens and laying of cleats and batten caps. The old battens, for example, had the narrower side of their trapezoidal shape uppermost. The library chief engineer, E. I. Gates and Sheet Metal Work Supervising Engineer L. Maurer, in applying new cypress battens, of the same shape, placed the wider sides of the battens uppermost, thus reversing them. The change was made to prevent buckling and creeping of the sheet metal between battens, it being considered that buckling occurred on the old roof due to lack of adequate metal expansion tolerance.

One of the causes of failure in the old roof was the cleats. The old cleats were nailed onto battens

There are about 142,000 square feet of roof to be covered with metal. Many weeks will be required. The material is being fabricated on the job.

Above—Spotting brackets along sections of cresting. The sections are put together to get a good fit prior to raising to the roof. Note brackets in several stages of compleion.



Right — Testing cresting brackets for fit and before soldering the bracket to the face section. This is standard procedure.

Above—New sections of the cresting in place showing a square mitre return in one corner. The old roof is being laid back out of the way.

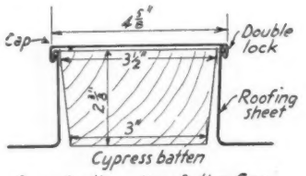
Left—Bending forms of Monel to make side pieces for the brackets. The notches are for turned edges. All brackets are soldered before applying.

Above — Soldering together various pieces which go to make up a bracket. The sides are soldered to the face piece and all soldered joints are then carefully filed down to get a smooth edge and joint.

Above—Cutters being used to remove old metal. Pinch bars are then used to break the old reglet caulking. The photo shows bad condition of old roof due to faulty application.

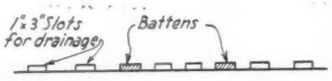
transversely and onto the outer surface of the batten caps whereas the new cleats will be applied directly to the battens, inside the batten caps, nailed on with nickel-copper metal nails transversely and the cleats locked into the caps.

Another interesting point about the new method of application has to do with the ends of the battens, especially the area between batten ends and gutters. Mr. Maurer designed special pieces that lock into the sheeting that covers the batten ends and, again, locks into the inner wall of the box-shaped gutters. The reason for the improvement is that if the battens should work through the metal at their ends, as occurred on the old roof, there should be no leaks at this point with the new management.



Cross Section - New Batten, Cap Roofing Connection - Old Battens were Reversed.

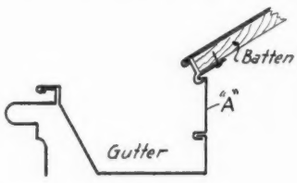
Still another new feature is the design of ventilator sides. The ventilator here extends along the ridge of the principal roof, being some 100 ft. long and has open sides with louvers to permit the escape of vitiated air exhausted from the library via an intricate fan system.



Front View of Storm Sheet "A".

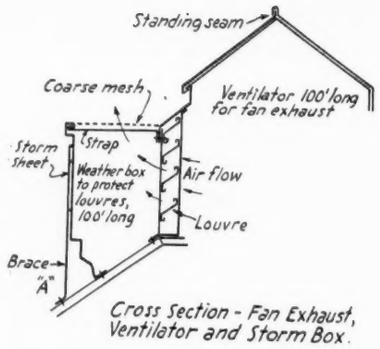
How to permit foul air escape without allowing snow and rain to enter called for the louvers which, in this case, are further protected by an exterior open-top box of sheet metal. To prevent pidgeons from nesting here coarse wire netting was spread over the top of the box. Drainage is provided by shallow slots at 6-in. intervals adjacent to the roof.

Following the removal of the old sheet metal, battens and accessories, a layer of heavy roofing felt was laid, then the new cypress battens, 3½ inches wide on top and 3 inches wide at the bottom, then batten caps and sheets, which are about 96 inches long by 30 inches wide. Battens are on 22-inch centers. Along the roof bases at the eaves are double ½-inch steel rod snow guards. Roof surfaces facing the inner area of the building, that is, the court, have a second snow guard of the same kind about half way between eaves and ridge. This affords extra protection, required because there is a glass roof on the first story court section which houses library reading rooms and which would suffer seriously should a snow slide occur on court sides.

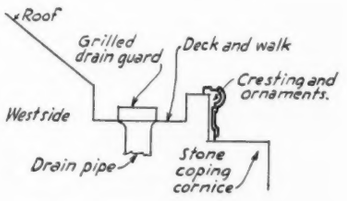


Gutter Detail - Piece "A" to Prevent Leak in Event Batten End Wears Through

Along all sides of the "upper" roof runs a 2-foot cresting with curved flutes 4 feet apart and soldered on. The cresting was fabricated in the workroom of the library. Two 8-foot sections of cresting were lock seamed and soldered together before applying to the roof. In fastening these 16-foot sections sheet metal screws first attached the cresting to the roof, just below decks, then section ends were lapped 1 inch, sweated over the entire lap, then soldered together. The roofing work as a whole required 8,000 sheets 30 by 96 inch.



Cross Section - Fan Exhaust, Ventilator and Storm Box.

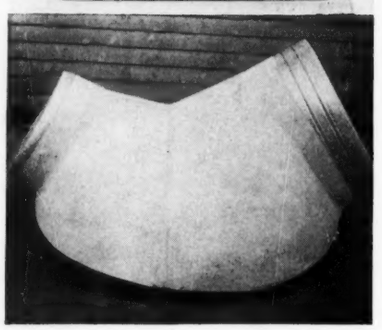


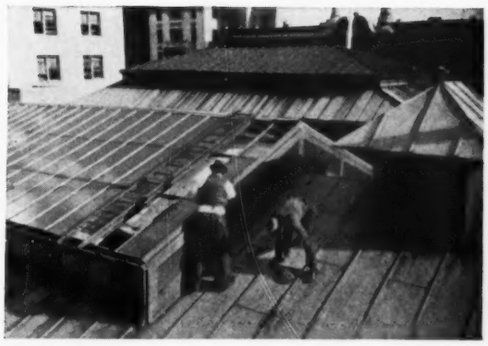
Section Showing Cresting

Modernization funds were acquired from the Federal Government. It is expected by Supt. Feddler, of the library, that some $5,000 will be salvaged from the sale of the old metal now being removed. Several months will be necessary to complete the new roof.

20-Year-Old Fittings

Bernard Blank of the Blank Furnace Co., 610 E. Dewald, Fort Wayne, Indiana, sends us two photographs showing fittings which he laid out and fabricated more than twenty years ago. These fittings were designed for gravity trunk line installation. One photograph shows a large round pipe, two-way hood, installed on a gravity heating system almost twenty years ago. The other photograph shows a large round pipe "Y" fabricated for a job and three small samples of bonnets for 1, 2 and 4-way takeoffs. Mr. Blank states that he uses these models to show customers what can be done in the way of neat workmanship and to prove his contention that many of the supposedly new ideas in pipe work are not actually new.





Left—The ladder, showing reinforcing boards nailed along the sides. Center—The ladder-scaffold on a skylight resting on ridge, eave and skylight bars. Right—Crew working on the ladder and along the end, cleaning bars from which a light has been removed.

A Ladder Scaffold for Skylight Repairs

By Lawrence E. Gichner
Washington, D. C.

THE facts are so simple, I hesitate writing about them. But had I known them a few months ago, I might have doubled my profits on a similar job.

In repairing a large skylight difficulty is often encountered in safely climbing about the structure. I have seen mechanics awkwardly straddling bars and shaking on makeshift boards, using ten minutes to get a hold for every five minutes' work.

A quick, rigid and safe scaffolding may easily be constructed from an ordinary straight ladder by simply nailing a 1 by 4-inch board against the sides as stiffeners and two other boards, one at the top parallel with the rungs to hook over the ridge and the other at the bottom to rest flat over the skylight bars.

Two such ladders on either side of the panes of glass being repaired give the mechanics a secure and firm footing from which to work. The ladders are easily manageable, speedily pushed along, and no danger need be feared in breaking glasses.

This method was successfully employed on the main skylight of the Riggs National Bank, Washington, D. C. Some 222 glasses 18 by 56-inches were removed from the 28 by 60-foot light over the huge main room. Extreme caution had to be exercised, as dozens of employees worked and thousands of customers daily walked, on the marble floors, fifty feet below.

Before we were awarded the contract, frequent small repairs over a period of years proved ineffectual in stopping leaks. After stripping the light we found the major source of trouble in the copper cross bar caps, which had worn thin and cracked through a combination of corrosion and erosion.

Biersach and Niedermeyer of Milwaukee built a scaffold like this when laying aluminum sheets on a steep church roof.

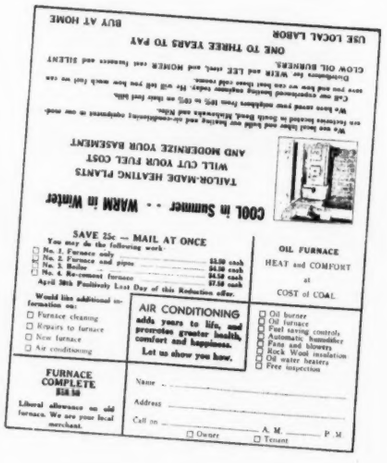
Originally glazed with 3/8-inch plain glass set in red roofing cement, the skylight was repaired from time to time with 1/4-inch ribbed wire glass. We find the 3/8-inch plain glass holds up better than the lighter glass with wire.

The adhering cement was chipped off of the old panes with the sharp end of a file. There is no question about the holding qualities of red roofing cement; but it is in its cracking that its defect lies. Cement recently replaced held the glasses tighter than old cement. The older the cement the easier it was to chip off.

The removed glasses were thoroughly cleaned. New copper cross bars were installed. The glass rests were painted with a high grade metallic ground in pure linseed oil. The glasses were set in an elastic gray steel sash glazing compound, and then capped; using new wedges.

Heavy snows and driving rains have assured the positive tightness of this method.

"My Cleaning Cards Didn't Pull—But Telephone Solicitation Gets 1 Order per 12 Calls."



SEVERAL contractors interviewed recently at conventions and meetings have made the interesting assertion that 1936 is a buyer's year in furnace cleaning and have proved their assertion by citing their experiences this spring. According to these men, prospective customers have flatly declared that they will pay such and such an amount for a cleaning job and that for this sum they expect certain things done.

In checking this somewhat unusual condition we mailed letters to a number of aggressive contractors who carry on cleaning campaigns every spring. Of the replies verifying the buyer's market statement or disproving it we will review several to show the sort of campaigns which seem to be drawing business this year.

For many years Arthur Rummel, South Bend, Indiana, has conducted a furnace cleaning campaign. Several years ago we reported a campaign in which he gave away ash cans and shovels as premiums. This was during the first of the depression when cleaning in South Bend was offered at $1.50 and $1.00 a job with few takers.

The Service Offered

This year's campaign is based on four services as shown on the mailing literature. Offer number 1 includes cleaning the furnace only (the radiator, combustion chamber and smoke pipe), nothing is done to the casing or pipes. Offer number 2, $4.50, includes number 1 plus cleaning the pipes, returns, register boxes, inside of casing, cold air shoes. Offer number 3 is for boilers at $4.50, a price which Rummel believes is justified because there is little chance for pipe work, new apparatus, additions and because in South Bend where most homes are warm air heated, the radiator system is generally in the home of a person who can afford a good price. Offer number 4 includes number 2 and in addition re-cementing of the furnace and complete inspection.

Return Cards

This spring some 8,000 cards like the one shown were placed in the doors of homes in South Bend by a hand bill agency. The cost of delivery was $1.50 per thousand. At this writing the results from the cards do not begin to pay for the campaign. Of the 8,000 cards about 2,000 were distributed several weeks after the first delivery. This second effort showed a better return, but still not enough to pay the cost.

Believing that cleaning is one of the best methods devised for getting into the basement and knowing that the past severe winter made necessary a thorough cleaning, Rummel devised a telephone solicitation. So far as can be ascertained cleaning has never been solicitated in South Bend by means of phone calls. A pleasant voiced woman, familiar with the heating and cleaning business was employed. She began at the "A's" in the telephone book and went straight through. If no answer was received later calls were made.

Usually the lady of the house answered the call. It was explained that a special cleaning offer was in effect and the various services were presented. If the housewife said she "didn't know," later calls were made. The housewife was not permitted to say "I'll call you later." If possible an appointment to call the housewife was made. In many cases several calls had to be made before a definite answer was secured.

In the average full day probably 100 persons are talked to. No calls are made on Saturday or Sunday. With several weeks of phoning behind, it is found that one call out of 12 results in a cleaning order.

Equipment

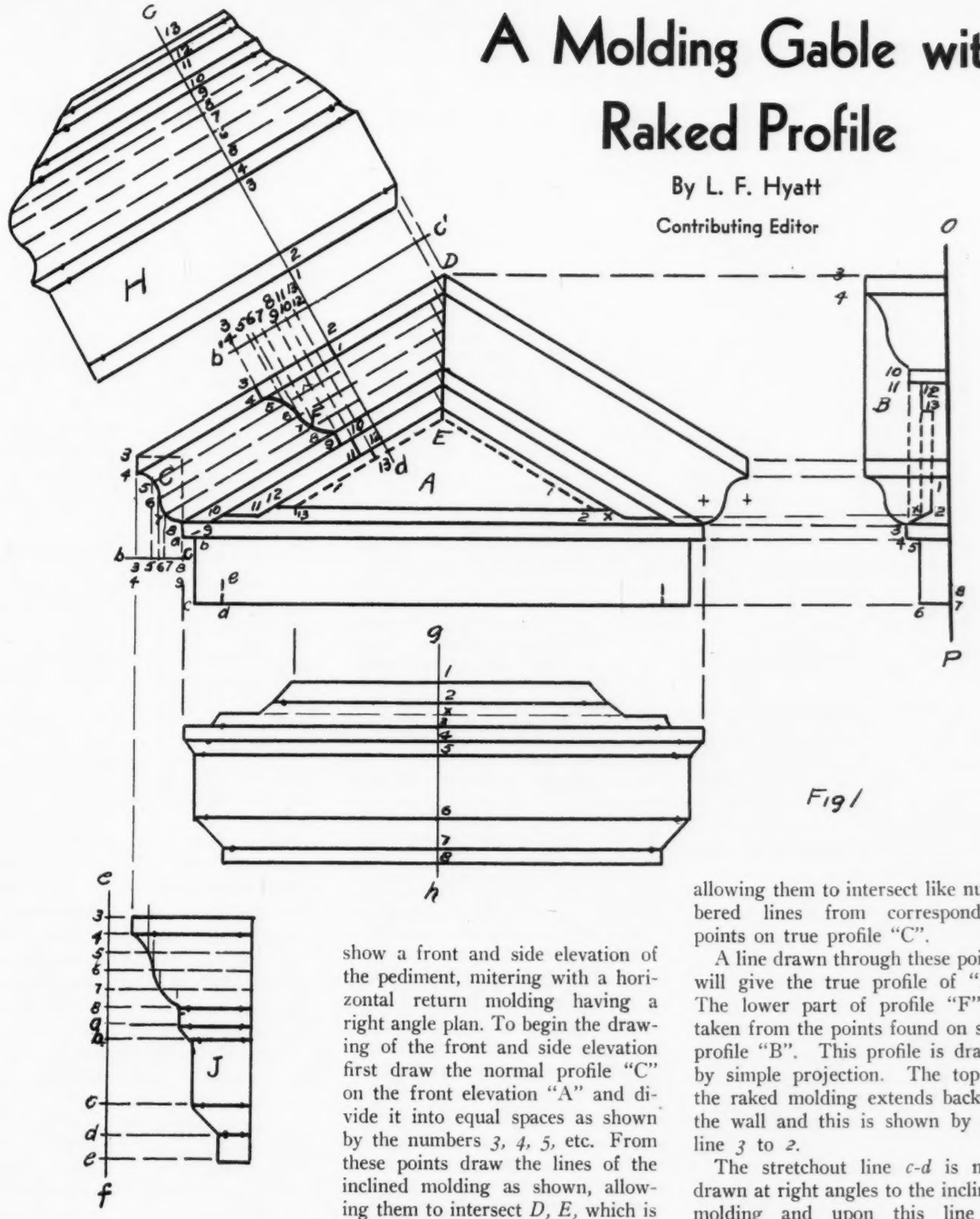
Rummel has three portable vacuum cleaners. The present system is to send two cleaners and two men to each cleaning job. One man and cleaner does the upstairs work; the other man does the basement work. This speeds up work (3 to 4 hours a job for number 2 offer) and helps to get the job done without any fuss, dirt, disorder or dissatisfaction. When the cleaning order calls for

(*Continued on page* 100)

A Molding Gable with Raked Profile

By L. F. Hyatt

Contributing Editor



OFTEN the layout man is called upon to develop patterns for gable ends of a building similar to the main cornice of a building. A molding of this kind is called a raked molding. When an inclined molding is to miter with a horizontal return molding, a change of profile in one of the moldings is necessary to insure a correct miter.

Details "A" and "B," Fig. 1, show a front and side elevation of the pediment, mitering with a horizontal return molding having a right angle plan. To begin the drawing of the front and side elevation first draw the normal profile "C" on the front elevation "A" and divide it into equal spaces as shown by the numbers *3, 4, 5,* etc. From these points draw the lines of the inclined molding as shown, allowing them to intersect *D, E,* which is the vertical line dividing the halves of the inclined molding on the front elevation.

It is now necessary to draw the raked profile "F". First drop vertical lines from each point on the true profile "C" allowing them to intersect the line *b-c,* and number these points as shown. Now take the divisions on *b-c* and place them on *b'-c',* which is drawn parallel with the lines of the oblique molding and from these points draw lines allowing them to intersect like numbered lines from corresponding points on true profile "C".

A line drawn through these points will give the true profile of "F". The lower part of profile "F" is taken from the points found on side profile "B". This profile is drawn by simple projection. The top of the raked molding extends back to the wall and this is shown by the line *3* to *2*.

The stretchout line *c-d* is now drawn at right angles to the inclined molding and upon this line is stepped off the distances found on profile "F". Each space must be carefully stepped off, separately, for they vary somewhat in length. Now draw the measuring lines through each of these points parallel with the lines of the oblique molding. Next, from each point on the true profile "C" and the miter line *D-E,* draw lines at right angles to the inclined lines of the oblique molding allowing them to intersect lines

(*Continued on page* 100)

Social Security—

A Summary of Its Old Age Benefits

By Joseph G. Dingle
C. P. A., Ottawa, Ill.

IN the preceding article the Old-Age Assistance provisions of this Act were discussed. Here, it is proposed to discuss what is called Old-Age Benefits. Under the former title, the Federal Government, under certain conditions, will refund a part of pensions paid by States to aged needy citizens. In this Old-Age Benefit title, the Federal Government proposes to do the paying itself—after the employers and employees in certain covered classes have paid in, as taxes, the funds presumably necessary to meet the future obligations.

TITLE II—FEDERAL OLD AGE BENEFITS

Like Title I, this Title II deals with old age. Title I purports to take care of those who are 65 years old *now*. Title II under the heading of "Old-Age Benefits" sets up a beautiful picture of secure old age for those who have not yet reached the age of 60 years and are employed in what is called the covered classes". But, like the other titles in this Act, Title II has many hidden faults. It is not what it appears to be. We quote first the "old-age benefit payments" section:

"Section. 202. (a) Every qualified individual (as defined in section 210) shall be entitled to receive, with respect to the period beginning on the date he attains the age of sixty-five, or on January 1, 1942, whichever is the later, and ending on the date of his death, an old-age benefit (payable as nearly as practicable in equal monthly installments) as follows:

(1) If the total wages (as defined in Section 210) determined by the Board to have been paid to him, with respect to employment (as defined in section 210) after December 31, 1936, and before he attained the age of sixty-five, were not more than $3,000, the old-age benefit shall be at a monthly rate of one-half of 1 per centum of such total wages;

(2) If such total wages were more than $3,000, the old-age benefit shall be at a monthly rate equal to the sum of the following:

(A) One-half of 1 per centum of $3,000; plus

(B) One-twelfth of 1 per centum of the amount by which such total wages exceeded $3,000 and did not exceed $45,000; plus

(C) One-twenty-fourth of 1 per centum of the amount by which such total wages exceeded $45,000.

"(b) In no case shall the monthly rate computed under sub-section (a) exceed $85.

"(c) If the Board finds at any time that more or less than the correct amount has theretofore been paid to any individual under this section, then, under regulations made by the Board, proper adjustments shall be made in connection with subsequent payments under this section to the same individual.

"(d) Whenever the Board finds that any qualified individual has received wages with respect to regular employment after he attained the age of sixty-five, the old-age benefit payable to such individual shall be reduced, for each calendar month in any part of which such regular employment occurred, by an amount equal to one month's benefit. Such reduction shall be made, under regulations prescribed by the Board, by deductions from one or more payments of old-age benefit to such individual."

This reads well but let us take it to pieces and see what it really means.

"(a) Every qualified individual (as defined in Section 210 (c) . . ." We quote section 210 (c):

"Sec. 210. (c). The term 'qualified individual' means any individual with respect to whom it appears to the satisfaction of the Board that—

Mr. Joseph D. Wilder,
Editor,
American Artisan.
Dear Mr. Wilder:

I have read in your May issue the first of the series of articles about the Social Security Act by Joseph G. Dingle, C. P. A., Ottawa, Illinois.

I am going to take advantage of the invitation you extended in your letter of May 14 to follow the series and make any comments I felt would be of interest.

I noticed in the first paragraph the statement that the tax set up by the Social Security Act on employers of eight or more is based on wages paid. You will no doubt be interested in the following quotation from the Bureau of Internal Revenue Regulations 90, article 201, "The measure of the tax is the total amount of wages payable by an employer with respect to employment during the calendar year, regardless of the time of actual payment." This may seem to be of minor importance, but a careful analysis will reveal it may make quite a difference in the tax returns for some employers.

In the third paragraph Mr. Dingle stated old-age benefits would be paid beginning January 1, 1942. This is true of monthly benefits but lump sum benefits will be paid beginning January 1, 1937. These lump sum payments will be paid to the estates of all persons dying after that date who have been employed in an occupation covered by Title II of the Social Security Act. Also, lump sum payments will be made after January 1, 1937, to persons working in covered employments who reach the age of 65 after that date and will not be qualified to receive the regular monthly benefits beginning January 1, 1942, because they have not earned as much as $2,000 between January 1, 1937, and their sixty-fifth birthday. In both cases the lump sum payments will be 3½ per cent of the total wages received under an occupation covered by Title II of the Act, between January 1, 1937, and death, or age 65, whichever occurs first. That portion of wages in excess of $3,000 received by an individual from a single employer in any one year will not be counted in figuring the total wages.

Sincerely yours,
Robert Huse,
Associate Director:
In Charge, Business Information Service
Social Security Board.

(1) He is at least sixty-five years of age; and
(2) The total amount of wages paid to him, with respect to employment after December 31, 1936, and before he attained the age of sixty-five, was not less than $2,000; and
(3) Wages were paid to him, with respect to employment on some five days after December 31, 1936, and before he attained the age of sixty-five, each day being in a different calendar year."

"Qualified Individual"

Let's analyze these requirements of a "qualified individual" as laid down.

1st: The Federal Social Security Board, composed of presidential appointees, must first be satisfied. Just what evidence will satisfy the board is hard to predict.

2d: At least $2,000 must have been earned after December 31, 1936, and before attaining the age of sixty-five. On the face of this requirement, it would appear, from section 202 quoted above, that the pension would be $10.00 per month (½ of 1% of such total wages). But the joker follows:

3d: Before becoming eligible for the so-called "Old-Age Benefit" he must have received "wages" with respect to "employment" on at least one day in each of five years AFTER DECEMBER 31, 1936, AND BEFORE ATTAINING AGE SIXTY-FIVE.

Wages are defined in Section 210 (a) as follows:

"The term 'wages' means all remuneration for employment, including the cash value of all remuneration paid in any medium other than cash; except that such term shall not include that part of the remuneration which, after remuneration equal to $3,000 has been paid to an individual by an employer with respect to employment during any calendar year, is paid to such individual by such employer with respect to employment during such calendar year."

Thus we see that wages are not what they seem—they do not include amounts in excess of $3,000 in any year, and must be paid "with respect to employment". Therefore, we must read the definition of "Employment" as found in section 210 (b) which reads as follows:

"The term 'employment' means any service, of whatever nature, performed within the United States by an employee for his employer, except—
(1) Agricultural labor;
(2) Domestic service in a private home;
(3) Casual labor not in the course of the employer's trade or business;
(4) Service performed as an officer or member of the crew of a vessel documented under the laws of the United States or of any foreign country;
(5) Service performed in the employ of the United States Government or of an instrumentality of the United States;
(6) Service performed in the employ of a State, a political subdivision thereof, or an instrumentality of one or more States or political subdivision:
(7) Service performed in the employ of a corporation, community chest, fund, or foundation, organized and operated exclusively for religious, charitable, scientific, literary, or educational purposes, or for the prevention of cruelty to children or animals, no part of the net earnings of which inures to the benefit of any private shareholder or individual."

The Benefits

Now, having defined "qualified individual," "wages" and "employment," we can again read Section 202 (a) more intelligently. It now has a more clear meaning and to phrase it as it really reads we have:

Everyone who on December 31, 1936 is under the age of 60 years, who has worked at least one day in each of at least five years after December 31, 1936, in service other than those enumerated in section 210 (b) and shall have earned at least $2,000 shall be entitled to receive a monthly old-age benefit beginning on the date he attains the age of sixty-five, or on January 1, 1942, whichever is the later, and ending on his death, computed as follows:

One-half of 1% of amount earned up to $3,000 plus

One-twelfth of 1% of amount by which such total wages exceeded $3,000 and did not exceed $45,000; (subject to a maximum annually of $3,000 in wages) plus

One-twenty-fourth of 1% of the amount by which such total wages exceeded $45,000 (subject to a maximum annually of $3,000 in wages).

Now, to point out another joker, we quote section 202 (d):

"Whenever the Board finds that any qualified individuals has received wages with respect to regular employment after he attained the age of sixty-five, the old-age benefit payable to such individual shall be reduced, for each calendar month in any part of which such regular employment occurred, by an amount equal to one month's benefit. Such reduction shall be made, under regulations prescribed by the Board, by deductions from one or more payments of old-age benefit to such individual."

Who Pays

Thus, in order to be entitled to this so-called old-age benefit, in addition to meeting all requirements enumerated above (sections 202(a), 210(a), 210(b), and 210(c)) one must cease any gainful regular employment. If he receives wages with respect to regular employment after he attains the age of sixty-five, he loses his monthly benefit for each and every month in which he had such "regular employment."

Notwithstanding all these "conditions" which must be met before becoming entitled to an "old-age benefit" after January 1, 1942, for three years after January 1, 1937, every employee in the "covered classes" of employment will have his employer withhold from his wages daily, weekly, or whenever paid, 1% of such wages (up to $3,000.00 in any year). Beginning January 1, 1940 and for three years thereafter the tax is to be 1½% of all wages (up to $3,000.00 in any year). For 1943, 1944 and 1945, the rate is 2%; then for 1946, 1947 and 1948, the rate is 2½%; and after January 1, 1949 the rate is 3%. These are "income taxes" and employers must deduct them from all wages paid—from regular employees and from casual employees if employed in employer's regular business.

In addition to these "income taxes" required to be deducted from the employee's wages, the employer must pay like amounts, called "ex-

(*Continued on page 96*)

The National Warm Air Mid-Year Meeting

W. L. Rybolt
President

THE mid-year meeting of the National Warm Air Heating and Air Conditioning Association held June 17 and 18 in Columbus, Ohio, attracted an excellent attendance and offered a program unusually complete in subjects pertinent to warm air heating and domestic air conditioning. The program was restricted to two morning and one afternoon sessions with a luncheon program the first day and no banquet or evening session. The concluding feature of the meeting was the annual golf tournament in which practically every player drew a prize, some of the prizes being very valuable.

President's Address

In his president's address, W. L. Rybolt declared that there seems to be every indication of at least one hundred per cent increase in home building during 1936 over 1935. The share of this building construction, which our industry will secure, will be determined primarily by the general aggressiveness of manufacturers, wholesalers and dealers. "This rosy picture," declared President Rybolt, "also has a few serious problems. First, there is labor. Indications point to a serious shortage of mechanics in foundries, fabricating plants, and mechanics for installing and fabricating duct work. There is also some indications of a summer slump, although evidence does not indicate how serious this slump will be. It is possible that the renewed building construction program now under way in practically all parts of the country will practically offset all slump as compared with 1935.

"It is also evident that the manufacturers and contractors must face rising costs. Materials are increasing in price, labor is asking for increased wages, and the mounting tax burden to be borne by manufacturers and contractors offers a serious menace. Our industry can not do much about increased labor and material costs, but it will be up to each individual to indicate his objection to increased taxation."

President Rybolt declared the association owes a debt of gratitude to Congressman Arthur Lamneck from Ohio, who during the last session of Congress objected strenuously to the increased taxation to be placed upon manufacturers and contractors. "One other serious problem," declared President Rybolt, "is the increasing number of large manufacturers now entering the residential air conditioning field. These large corporations have extensive staffs of trained engineers, ample financing, and believe in aggressive advertising. These corporations are capitalizing on the fact that the public is not interested in our industry's feeling that the residential air conditioning is our birthright. The public is interested in purchasing comfort. And the problems of supplying comfort as well as who is to sell the apparatus and install systems, must be met by our industry and the individual manufacturer or contractor through more aggressive salesmanship. A question we must face is what are we going to do about new design, new products, the national advertising and publicity, the research work which these so-called outside industries are aggres sively selling.

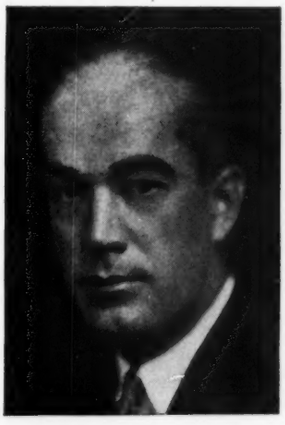
"The radiator heating industry, represented by manufacturers and contractors, has started an aggressive advertising campaign to acquaint the public with the advantages of radiator heat. So far as we can judge this industry is working together while our manufacturers, jobbers and dealers are disorganized and unaccustomed to working together. I believe that an aggressive membership campaign to include all manufacturers, jobbers and dealers as well as the mail order houses, direct-to-user, and such companies as are now in our field, is the solution to warm air-conditioning. We must make up our minds that advertising on a national scale is absolutely essential and we all must be willing to contribute some amount of money toward the expense of such a national campaign. Such an organization has never been able to nor never will be able to regulate prices, but such an association can control research, publicity and can bring the message of warm air-conditioning up to the public."

Salesmanship

R. D. Marshall of the Williams Oil-O-Matic Company, Bloomington, Illinois, declared that this industry as he sees it has little to fear from the large manufacturers now entering the field. These manufacturers have nothing better in the way of merchandise than our industry can offer. But they do believe in advertising and merchandising and it is in this field that they

will give us our greatest battle. Our industry, declared Mr. Marshall, must face the problem of securing and training better salesmen. The salesman is the final link in the movement of apparatus and systems from the manufacturer through the contractor to the buying public. We must train our future salesmen along lines other industries more merchandising minded have already undertaken. We must equip our salesmen with proper preparation in order that the salesmen may know more about the actual business of selling." Selling is an art, a method or process by which the salesman confers to another his own conviction of the product he sells. We must learn to sell effect rather than apparatus or systems. The buyer is interested in comfort and will pay whatever is necessary to secure such comfort. Salesmen must know more about the product they sell so that they can describe the effect which the customer has in view.

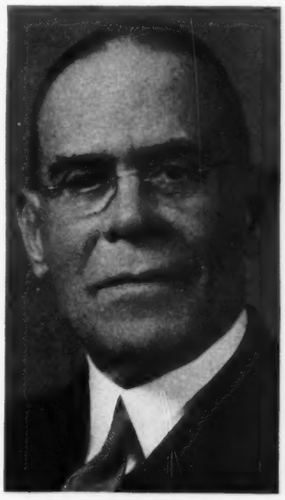
"Our industry must realize that a successful sales campaign consists of several important steps. We must learn how to canvass and how to make the proper canvassing calls; we must acquaint ourselves with the value of heating surveys in order that an economical and satisfactory system can be recommended. We must utilize call backs on new and old customers in order that no prospect will be overlooked. We must learn the value of presentations and demonstrations in order that costly sales methods can be utilized to the fullest advantage. We must realize the value of word-of-mouth advertising. Telephone solicitation and direct mail or newspaper advertising are valuable and must be used. These are the sales methods used by the large corporations and the methods that we will have to use to compete with them."



L. R. Taylor,
First Vice President

National Publicity

Along the line of President Rybolt's plea for a national advertising campaign directed to the public, a plan was proposed whereby $25,000 to be contributed by manufacturers and members of the association will be used, not in paid advertising, but in the preparation and distribution of newspaper and magazine publicity to acquaint the public with all of the facts relating to domestic air conditioning. Pledge cards were distributed with the request that they be filled in for the amounts of money to be contributed to such an advertising program. The association will report by mail at a later date just how much money has been collected and how much of a campaign can be conducted with the funds available.



Allen W. Williams,
Managing Director

Why Not Profit?

H. F. Sharp, Henry Furnace & Foundry Co., Cleveland, Ohio, speaking on the subject "Why Not a Profit From Air Conditioning?" declared that a hasty answer to the question implied might be "Increase Your Sales and Cut Your Costs," but that such an answer leaves much to be desired. "This industry of ours believes, and rightly so, that air conditioning belongs in this industry because we pioneered and sponsored the experimental work at tremendous expense and as an industry we possess the experience which enables us to recommend and install the best type of air conditioning system.

D. W. Norris,
Second Vice President

"Viewing our competition today, we find a split system group putting on an extensive publicity campaign and another group which might be called national appliance concerns well equipped with merchandising ideas and plenty of money aggressively selling their product and services but finding considerable difficulty with the practical problems encountered. These national appliance concerns have a perfect right to enter our industry. It is recorded that in 1935 these concerns sold more than 50,000 air conditioning units. Our only hope lies in the fact that we have the experience—we know how to lay out and install—we know the mistakes that have been made and how to avoid them, we have a long established group of satisfied users, but our greatest trouble lies in the fact that our businesses were built up during the years when competition was not really as it is today. We are, therefore, not as well equipped to merchandise aggressively as are these national appliance organizations. Those of us who do not make up our minds to merchandise as aggressively as these other organizations will find ourselves completely out of the air conditioning picture in less than five years.

"I like to think of the manufacturer and dealer as partners—they really are because one can not prosper without the other. If the two will work together, we can lick this problem of making more sales and securing larger profits. To maintain our standing, we must take sufficient interest to see that the customer has the job in perfect order and understand how to operate it when the system is turned over to him. If I were in the retail business, I would consider as my best sources of prospects the users of my system, yet we find that thousands of home owners do not know who to call on when needing service, filters, repairs, etc.

"A year ago we had pointed out to us that there are in the United States, more than 6,000,000 homes with warm air heating, about 2,000,000 with steam, vapor or hot water, and over 7,000,000 with no central heating system. These 6,000,000 homes with warm air heat can easily be converted into air-conditioning. When we add to this the 7,000,000 homes without central heat and the millions of new homes which will be built, we must admit that the opportunities which confront us is tremendous.

Prefabricated Ducts

Addressing the convention on the general subject of prefabricated pipe and duct, Harry R. Jones of Lamneck Products, Incorporated, Columbus, declared that the new forced air heating systems have made popular rectangular ducts and fittings. Until recently much of this rectangular duct work was fabricated by the contractor in his shop, or built to special order or the manufacturer of the furnace or the manufacturer of pipe and fittings. Speaking of his own company's activities in this particular field, Mr. Jones declared that it seemed impossible at first to standardize the many sizes of pipes and fittings in use, but that research disclosed that such standardization is possible and greatly reduces price per length of pipe. Practically no problem was presented so far as stacks and stack fittings were concerned as the same standard sizes and general construction is used for mechanical heating as has been used for many years in gravity heating. A solution to the problem was disclosed when it became evident that the many engineers and contractors prefer to run ducts and branches across the basement as one common type depth duct, making the reduction in the size in the width instead of depth. This led the Lamneck Company to manufacture a standardized side rail, using a Pittsburgh lock top and bottom and cutting flat sheets to the desired width.

Stoker Firing

"A Study of Stoker Firing in a Warm Air Furnace" was the subject of an address prepared by Burton E. Shaw, Research Chief, Penn Electric Switch Co., Des Moines, Iowa, and presented by Paul R. Luscombe of the same company in Mr. Shaw's absence. Mr. Shaw declared that the rapid increase in application of stokers to domestic heating systems has been paralleled by the development of automatic controls to utilize the maximum comfort available. He stated that the artificially heated type of thermostat has made possible the control of room temperatures within very narrow limits. By means of slides, a ten-room residence in Des Moines was shown as one of the test residences of the 1935-1936 heating season.

This uninsulated house had a heat loss of approximately 127,000 Btus. per hour, had a cast iron furnace rated at 169,000 Btu per hour output at the bonnet, a grate area of 2.58 sq. ft. and a stoker capable of burning 17 to 50 pounds of coal per hour. The stoker was set to deliver 28 pounds per hour, and the stoker was controlled by an artificially heated type of thermostat up stairs. A fan and limit switch in the bonnet prevented overheating and controlled the operation of the blower—the blower operated only during the on period when the thermostat was calling for heat. The thermostat was located 30 inches from the floor. Complete data on inside and outside conditions were maintained by automatic devices.

In one of the tests the thermostat was set to control the average variation in room temperature at the thermostat of about one-fourth of one degree and tests were run on short, medium and long cycle-operations of the stoker. Short cycles of operation gave the maximum comfort conditions and the most economical fuel consumption. Medium cycling or close temperature control was a little less economical, particularly in milder weather. Long cycling resulted in the least economical and the most uncomfortable operation. It was interesting to note that all of the curves on charts shown converged with very cold weather, but drew apart as the weather became milder. Tests indicated that because a stoker fire never goes completely out, long cycling and long standby periods do not result in the same fuel saving with the stoker as with an oil burner. Tests also indicated that the highest efficiency occurred when the excess air to the stoker was at a minimum. Long on cycles resulted in high stack temperatures, increased fuel consumption, and decreased efficiency. Also the amount of ash increased and room temperature variations increased.

Zone Control

Under the general subject of automatic controls for warm air heating and air conditioning, G. D. Kingsland of the Minneapolis-Honeywell Regulator Company, Minneapolis, declared that more progress has been made in the last four years in equipment than was made during all the time previous. Modern control systems are suitable for any size or type of building and offer such flexibility that practically any amount of apparatus can be used with satisfactory results, providing the installer follows fundamentally accepted principles of operation. Mr. Kingsland declared that zone control has become popular, because it increases flexibility and gives the owner practically any temperature condition he desires in any room or part of his house. Not every type of house requires zone control, but even in the smaller structures the difference in exposure oftentimes can be compensated for by zone distribution resulting in a much more satisfactory system than where one thermostat is employed. For example a house may be zoned first floor and second floor; it may be zoned according to

(*Continued on page* 86)

AIR CONDITIONING SECTION

IN the second part of Professor Kratz's paper on "Factors Effecting Comfort" the author deals with those much discussed subjects—temperature gradients in rooms, location of the thermostat and humidification. The facts he presents indicate an unlimited field for future research.

- - - A very interesting result report where a furnace blower and an attic fan were used for summer ventilation and night air cooling is described by M. W. Pehl. The plotted results add considerably to our data on this subject.

- - - We conclude in this issue two very important papers. The first explains cooling the Research Residence with city water and the second brings to an end an explanation of an all-inclusive method of procedure for determining the cooling load.

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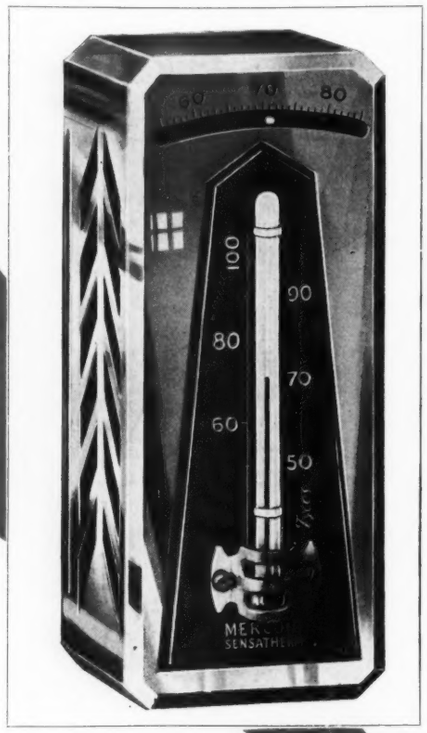

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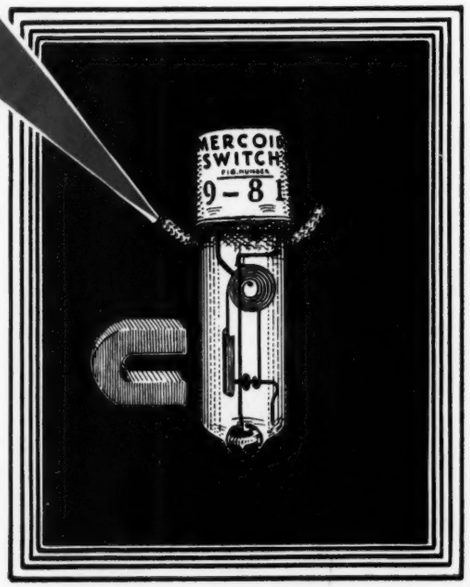

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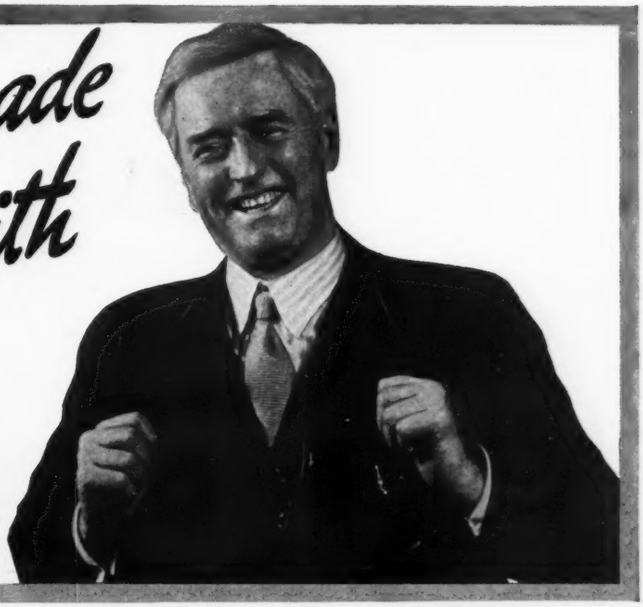

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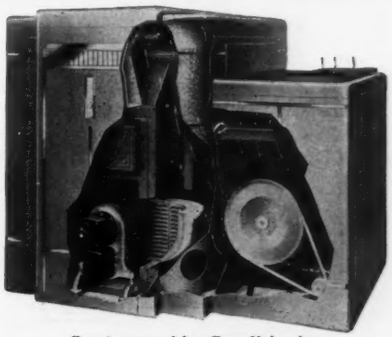

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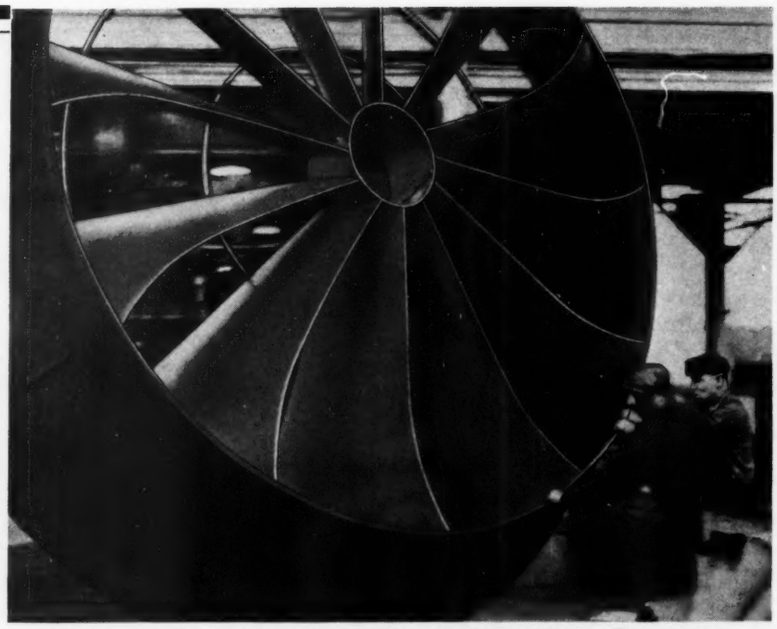

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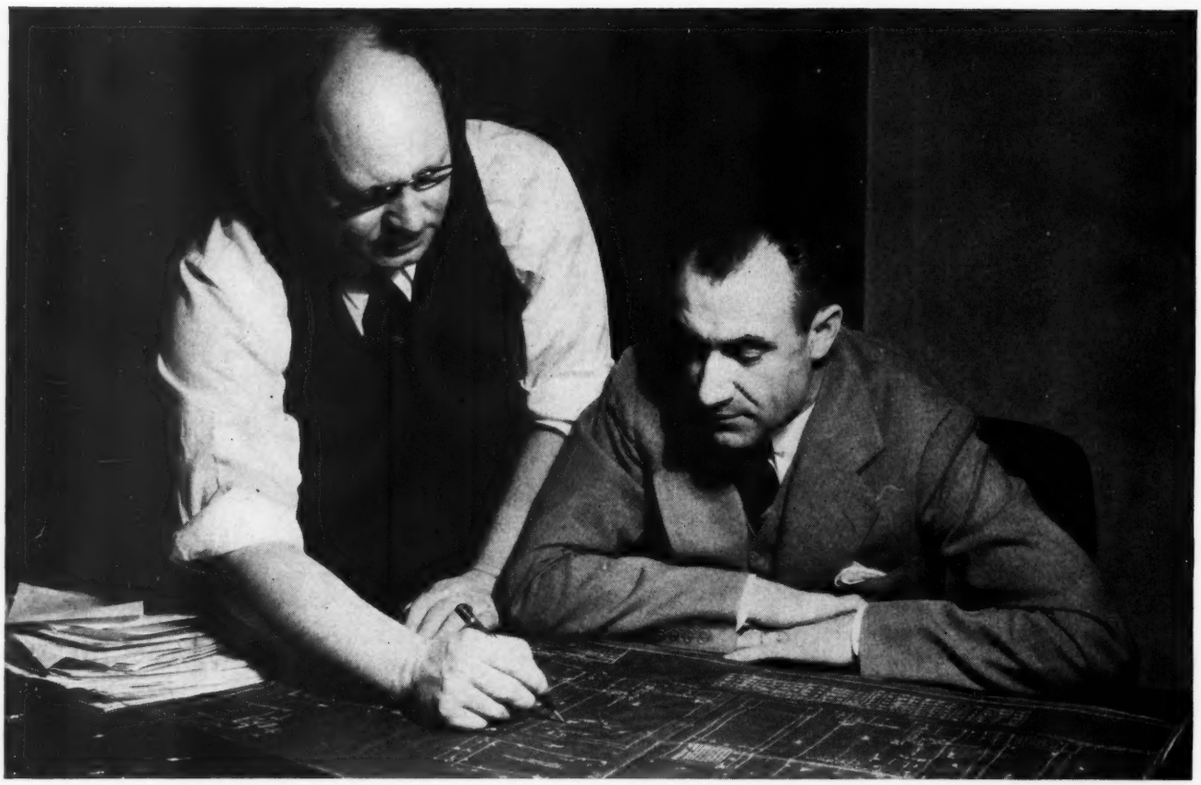

E. A. Jones, Chief Engineer, L. J. Mueller Furnace Co., Milwaukee, points out a few vital facts about heating and air conditioning plans to President Harold Mueller.

GOOD FROM THE BLUE-PRINT UP

"MISUNDERSTANDINGS are caused by not having understandings in the beginning." That's a maxim my father taught me when I still had to stand on tiptoes to reach the doorknob. It's true in the building of furnaces and boilers, just as it is true in building business and social relationships with human beings.

Long ago my father and his father before him practiced the policy of starting at the drafting board to build good furnaces and boilers. And I have made it a point to follow the pattern which they so wisely cut.

Some people think I lean over backwards in insisting that quality begin at the blue-print — but fortunately Ed Jones, our Chief Engineer, is a stickler for precision, just as I am. You have no idea how vital this thoroughness has been during the days of pioneering automatic heat and air conditioning.

There has been such a lot of confusion and so much hysteria in the field of air conditioning that our policy of "good from the blue-print up" has proved to be a fine stabilizing influence. It has kept us out of the stampede of the inexperienced and has helped to augment our reputation for dependability in this vast new automatic heat and air conditioning market.

You have my personal assurance that you can buy, sell and recommend Mueller products with confidence.

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MUELLER-MILWAUKEE

Study of Summer Cooling in the Research Residence Using Water from the City Water Mains§ [Part II]

By A. P. Kratz,* M. K. Fahnestock,** S. Konzo,† and E. L. Broderick‡
Urbana, Ill.

This paper is the result of research sponsored by the American Society of Heating and Ventilating Engineers, in co-operation with the National Warm Air Heating and Air Conditioning Association and the University of Illinois, and conducted in the Research Residence at the University of Illinois

Operating Characteristics With Constant Dry-bulb Temperature

THE operating characteristics with a constant dry-bulb temperature in the rooms of approximately 80 F. are shown in Fig. 4, for a day on which the outdoor temperature rose to a maximum of 96 F. During the night before, when the second story windows were opened and outdoor air was circulated, the indoor dry-bulb temperature dropped to 78 F. and remained at this value until 7:00 a. m., when the windows were closed and the dampers were changed to recirculate the air in the house. The dry-bulb temperature rose to 79 F. at 8:50 a. m. at which time the thermostat opened the water valve. The plant then operated intermittently until 11:20 a. m., and continuously from 11:20 a. m. to 9:30 p. m. maintaining the dry-bulb temperature between 79 and 80 F.

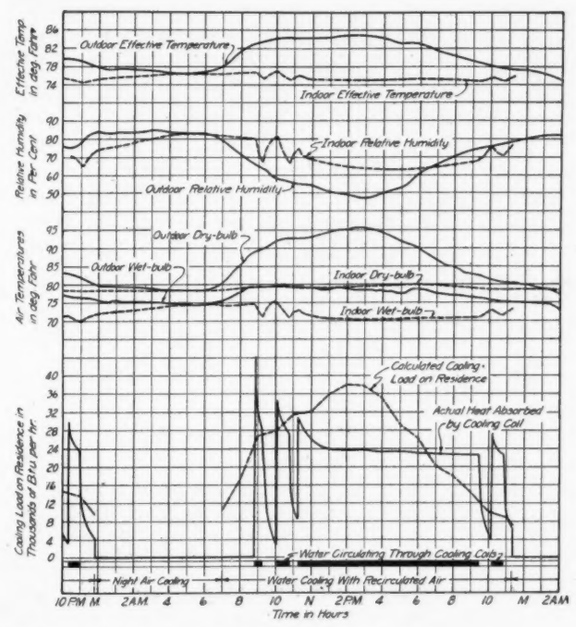

Effective Temp in deg Fahr
Outdoor Effective Temperature
Indoor Effective Temperature
Relative Humidity in Per Cent
Indoor Relative Humidity
Outdoor Relative Humidity
Air Temperatures in deg Fahr
Outdoor Dry-bulb
Outdoor Wet-bulb
Indoor Dry-bulb
Indoor Wet-bulb
Cooling Load on Residence in Thousands of Btu per hr.
Calculated Cooling Load on Residence
Actual Heat Absorbed by Cooling Coil
Water Circulating Through Cooling Coils
Night Air Cooling
Water Cooling With Recirculated Air
10 PM M. 2AM. 4 6 8 10 N 2PM 4 6 8 10 M 2AM
Time in Hours

Fig. 4—Actual and calculated cooling load on residence and air temperatures, Test No. 13, Series 1-35, August 2, 1935; with night air cooling

At 8:50 a. m. the wet-bulb temperature was 75 F., corresponding to a relative humidity of 80 per cent. When the plant started the relative humidity dropped to 67 per cent, but rose again to 81 per cent almost immediately after the water valve closed. This alternate decrease and increase of relative humidity in the house was characteristic of the intermittent operation of the plant. When the plant operated continuously, however, as from 11:20 a. m. to 9:30 p. m., the relative humidity stabilized at between 63 and 66 per cent, representing an effective temperature of approximately 75 F. During the intermittent periods the effective temperature was at times as high as 77 F. That is, on a warm day, when the plant operated continuously, conditions were just on the upper borderline for comfort, but during the periods of intermittent operation the effective temperature was distinctly too high for comfort. The significance of this type of operation on a milder day will be referred to later, but conditions shown in Fig. 4 indicated that for 58 F. service water, with which it was not found possible to obtain a relative humidity lower than 62 per cent,

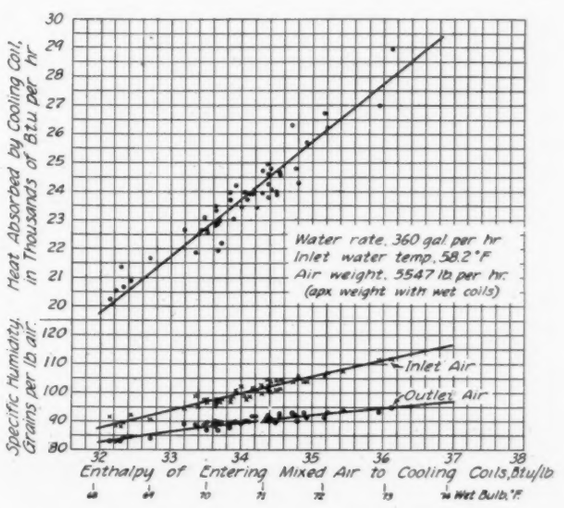

Heat Absorbed by Cooling Coil, in Thousands of Btu per hr
Water rate, 360 gal per hr
Inlet water temp, 58.2 °F
Air weight, 5547 lb per hr.
(apx. weight with wet coils)
Specific Humidity, Grains per lb air.
Inlet Air
Outlet Air
Enthalpy of Entering Mixed Air to Cooling Coils, Btu/lb
Wet Bulb, °F

Fig. 5—Performance of cooling coils

*Research Professor, Engrg. Experiment Station, University of Illinois.
**Research Assistant Professor, Engrg. Experiment Station, University of Illinois.
†Special Research Associate, Engrg. Experiment Station, University of Illinois.
‡Research Assistant, Engrg. Experiment Station, University of Illinois.
§Paper presented at the Joint Session of the American Society of Heating and Ventilating Engineers and National Warm Air Heating and Air Conditioning Association, 42nd Annual Meeting, Chicago, Ill. January, 1936. See A.S.H.V.E. JOURNAL SECTION of *Heating, Piping and Air Conditioning*, May, 1936.

the dry-bulb temperature should be maintained somewhat lower than 80 F.

The calculated cooling load was computed by the method outlined in a previous paper.[6] The calculated load was greater than the actual load during the period from 11:15 a. m. to 6:30 p. m., rising to a maximum value of 38,000 B.t.u. per hour at 2:30 p. m. as compared with an actual load of 24,000 at the same time. After 6:30 p. m. the calculated load became less than the actual load. This tendency for the actual and calculated load curves to cross at approximately 6:30 p. m. was also noted on the previous work with ice cooling and with the mechanical refrigerating unit.

During the periods of intermittent operation the actual cooling load curve showed high peaks at the start of each operating period. These peaks correlated with periods of high indoor relative humidity, indicating that periods of high wet-bulb temperature for the air entering the coil were accompanied by corresponding periods of comparatively high heat transmission for the coil. An explanation for this correlation is offered by Fig. 5.

Heat Transmission of Coils. The upper curve in Fig 5 shows that the heat absorbed by the coil was practically a linear function of the enthalpy of the entering air. C. J. Scanlan[7] has shown this to be true for a different type of coil when the velocity of the air and the mean temperature of the refrigerant in the coil were maintained constant. The deviations of the points from the mean curve shown in Fig. 5 can therefore be explained by variations in mean water temperature, and in the weights of air and water circulated under the conditions of the tests. The maximum deviation shown, however, was only 6 per cent.

During these tests a constant indoor dry-bulb temperature was maintained, resulting also in a practically constant dry-bulb temperature for the air entering the coil. Hence, periods of high relative humidity also represented periods of high wet-bulb temperature with corresponding high enthalpy for the air entering the coil; and since Fig. 5 shows that high heat transmission accompanied high enthalpy for the air entering the coil, it also serves to explain the fact that the peaks in the load curve in Fig. 4 occurred at times corresponding to high indoor relative humidity.

Although the same type of curve as that shown in Fig. 5 also applies to the evaporator coil used in connection with the mechanical refrigerating unit for the studies in the summer of 1934, this plant did not show the high peaks in the load curve which were characteristic of the water cooling plant. In the case of the evaporator coil the heat transmission at the time of starting was limited by the amount of refrigerant that could enter the coil. This refrigerant would tend to superheat, thus increasing the temperature of the coil surface and offsetting the tendency for the heat transmission to increase with an increase in the wet-bulb temperature of the entering air.

The curves in Fig. 6 show that during periods of continuous operation, both in the case of the water coil used in the study in 1935 and in the case of the mechanical refrigerating unit used in the study of 1934, the indoor specific humidity maintained was dependent only

[6]Loc. cit. Note 3.
[7]Performance of Extended Cooling Surfaces, by C. J. Scanlan, *Refrigerating Engineering*, Vol. 27, No. 4, April, 1934, pp. 197-199.

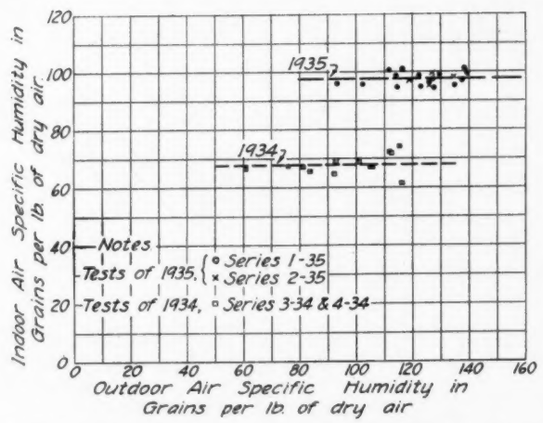


Fig. 6—Specific humidity of indoor air resulting from operation with two types of cooling systems

on the temperature of the medium used and the character of the cooling coil and was independent of the amount of water vapor in the outdoor air. Since in both cases a constant indoor dry-bulb temperature of 80 F. was maintained, the specific humidity is also representative of the indoor relative humidity. That is, the water coil used in 1935 with a mean water temperature of approximately 62 F. maintained a constant indoor relative humidity of 63 per cent during periods of continuous operation, while the evaporator coil used in 1934 with a mean temperature of approximately 45 F. for the refrigerant maintained a constant relative humidity of 45 per cent.

During periods of operation the ventilating air from outdoors was mixed with the recirculated air from the house just before entering the cooling coil. The moisture content of the outdoor air therefore directly influenced that of the mixed air entering the coil. The lower curves in Fig. 5 indicate that the enthalpy of the entering air increased as the specific humidity increased, resulting in an increase in the heat transmission for the coil. At the same time the specific humidity of the air leaving the coil increased, but not to as great an extent as that of the inlet air. This indicates that a part, if not all, of the increase in heat transmission was utilized in increasing the amount of condensation as the specific humidity of the outdoor air and hence that of the air entering the coil, was increased. Thus the increasing heat transmission of the coil tended to compensate for increases in the outdoor specific humidity, and, as a result, also tended to maintain a constant indoor relative humidity during periods of continuous operation, as shown in Fig. 6.

Operating Characteristics With Constant Effective Temperature

Fig. 7 shows the performance of the Residence on two mild days, during which the operation of the plant was intermittent and no long periods of continuous running occurred. The left hand side shows the operation on a day on which the outdoor temperature rose to a maximum of 87 F. and a constant indoor dry-bulb temperature of approximately 80 F. was maintained. Owing to the short operating periods, the indoor relative humidity ranged from 68 to 80 per cent with correspond-

ing indoor effective temperatures of from 76 to 77.5 F. At no time could the conditions be regarded as comfortable. A study was therefore made on a similar day on which the maximum outdoor temperature rose to 86 F. and during which the plant was manually controlled to maintain an indoor effective temperature not to exceed 76 F. The results of this study are shown in the right hand side of Fig. 7. The second story windows were closed at 7:00 a. m. and at 10:00 a. m. the indoor dry-bulb temperature was 75 F. and the relative humidity was 90 per cent, corresponding to an effective temperature of 74 F. The plant was then started and the relative humidity decreased to 74 per cent giving an effective temperature of 72 F. at 11:00 a. m. at which time the plant was stopped. Subsequent to this the plant was started manually whenever the effective temperature approached 74 F. with the prevailing dry-bulb temperature was stopped whenever the effective temperature dropped to 73 F. With this method of operation the indoor dry-bulb temperature gradually increased to 77 F. and the relative humidity decreased to vary between 70 and 80 per cent during the on- and off-periods of operation. By this means comparatively comfortable conditions were maintained in the house during the entire day.

The results of these studies indicate that it would be desirable to develop a means of control operating directly on effective temperature. With 58 F. service water available, and with a constant dry-bulb temperature of 80 F. maintained, on warm days, when the maximum outdoor temperature rose above 90 F., and when the plant could operate continuously, a material improvement in atmospheric conditions was effected that would be acceptable to the majority of users, even though optimum conditions were not obtained. On mild days, however, this could not be accomplished with a constant dry-bulb temperature of 80 F., but by setting the thermostat to maintain approximately 76 F. acceptable conditions could be maintained. The results further indicated that 60 F. is probably the upper practical limit for the temperature of the available cooling water. With higher initial water temperatures the amount of dehumidification or reduction in indoor relative humidity would be very small. Consequently, room temperature considerably lower than 80 F. would have to be maintained and the amount of coil surface required would be excessive.

Factors Affecting the Selection of Cooling Coils. In selecting the cooling coils required to absorb the maximum cooling load on the Research Residence, it was found that there was considerable latitude in the choice, provided no restrictions were placed on the amount of cooling water or the amount of coil surface used. The cooling load was estimated at 20,000 B.t.u. per hour sensible heat and 7,000 B.t.u. per hour latent heat. With 80 F. maintained in the rooms, the restriction of 70 F. for the temperature of the air leaving the registers, together with the known rise of 4 F. in the duct system, determined that the temperature drop of the air passing through the coil should be 15 F.; or from 81 F. to 66 F. This drop in temperature, together with the sensible heat load, limited the air requirement to 1300 c.f.m. A net face velocity of 365 f.p.m. permitted the use of an air duct of reasonable dimensions, and thus fixed the face area of the coil. The freedom of choice then proved to be in the amount of coil surface, or the number of rows of coil to be used.

The curves in Fig. 8 were computed from the data furnished by the manufacturer of the coils, and indicate that the required temperature drop in the air could be obtained either by the use of a large amount of cooling

(*Continued on page* 48)

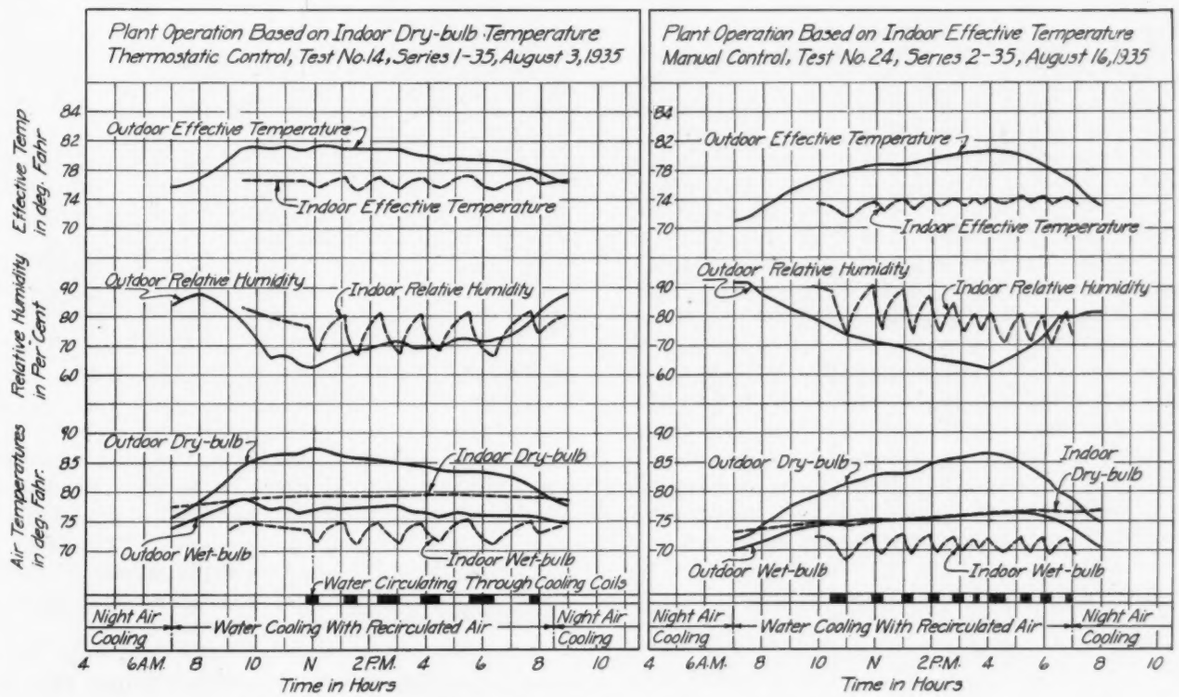
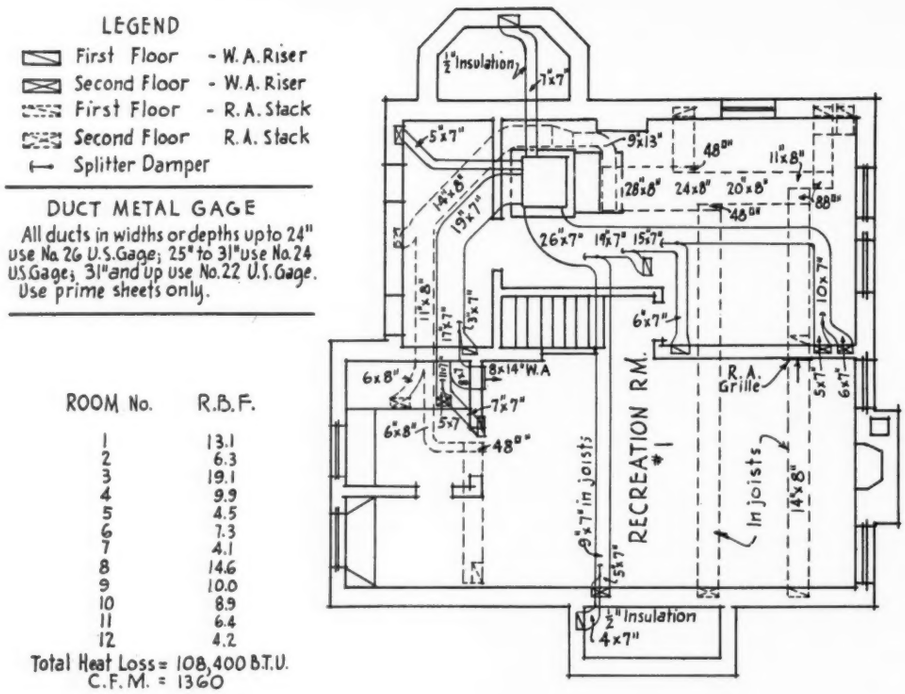

Plant Operation Based on Indoor Dry-bulb Temperature
Thermostatic Control, Test No.14, Series 1-35, August 3,1935
Plant Operation Based on Indoor Effective Temperature
Manual Control, Test No.24, Series 2-35, August 16,1935
Effective Temp in deg. Fahr.
Relative Humidity in Per Cent
Air Temperatures in deg. Fahr.
Outdoor Effective Temperature
Indoor Effective Temperature
Outdoor Relative Humidity
Indoor Relative Humidity
Outdoor Dry-bulb
Indoor Dry-bulb
Outdoor Wet-bulb
Indoor Wet-bulb
Water Circulating Through Cooling Coils
Night Air Cooling
Water Cooling With Recirculated Air
Night Air Cooling
4 6A.M. 8 10 N 2P.M. 4 6 8 10
Time in Hours

Fig. 7—Indoor and outdoor temperature conditions with cooling plant operation based on indoor dry-bulb temperature and indoor effective temperature



"Cost Per Pound" or "Price Per Opening"— Which Is the Best Way to Estimate Pipe Cost?

By Eugene P. Farris
Managing Director
Central Bureau for Heating and Air Conditioning, Cleveland

MUCH has been said on the subject of the proper way to price a residential air conditioning job and whereas experience is probably the best teacher it is from experience that this article shall be written.

Following an engineering procedure the heat loss of any type and kind of residential structure is calculated and for designing purposes a register temperature and suitable velocity is chosen. The C. F. M. requirement is established when the other two quantities are known. With this information established, the design begins and for a given room let us assume that a 10x3½-inch riser connecting to a 10x6-inch stack head shall be run through the partition wall being connected to the main or branch trunk in the basement by a converting piece sized to an equal capacity. The size of the branch connection as to width and depth is usually established by the depth of the main or branch trunk line. This procedure of design holds true for every heat supply line on the entire system whether it be a job of 10 openings for heat or whether it be a job for 30 openings. It is on this basis that a great many men say to themselves that it is possible to price a job on the basis of so much per opening when the condition of bringing the job back to the basement is identical for every riser.

It is the experience of the writer, after having directed the designing of approximately 800 systems for the greater Cleveland territory, that pricing on a per opening basis is not a possibility that truly exists and that to price a job on the basis of a per opening price will in no sense be reliable when one considers that a great many openings require cross-overs, additional elbows, etc. and that the total amount of pipe, whether it be in round or rectangular duct will vary in every instance on almost every run. This is true with regard to the risers from the basement to the warm air openings wherever they shall be.

Basement duct work will, in practically every house, be different and the poundage may vary all the way from 250 pounds to an unlimited poundage, depending on the structure itself. When any one attempts to figure a job on the basis of openings they must consider poundage as a material factor in the price quotation, primarily because of the fact that when the fabricator buys sheets to make up this job the sheets are sold to him on the basis of poundage and this quantity of iron varies from job to job. Therefore, the metal cost to the fabricator fluctuates from job to job.

It is absolutely impossible to come within any reasonable degree of accuracy in estimating a job when a per opening price is quoted, unless of course, the sheet metal fabricator insists on opening his doors to the

administration of his affairs by the owner, contractor, jobbers, manufacturer or sheriff.

Every successful business in the world operates on the basis of understanding that over-head consisting of rent, light, heat, phone, depreciation on equipment, insurance, gasoline, oil, depreciation on automobiles, ladders and other equipment must be reckoned with and figured in on a percentage basis for every job that he performs. We therefore establish the fact that over-head is an item.

It is a well known and proven fact that if we take off a job in poundage by using the dimensions as expressed on a heating layout we must figure into that same poundage an additional percentage of material for waste in cutting which can not be figured at less than 15%. We also have the items of straps and hangers, stiffening seams, dampers, etc. All of this accounts for additional poundage on the job therefore, an additional 10% must be added for straps and hangers, stiffening seams, etc.

Cleveland Institute's Experience

The city of Cleveland for new house construction demands that union labor be used and the price of union labor in this city is $1.25 per hour. The union does not permit the use of helpers or junior tradesmen. The labor cost on erection of ducts already fabricated in other words just the erection of risers and stack heads, is estimated to be a minimum of $6.75 per opening; with an additional charge for the installation of register faces which must be installed at another time and as another step as the building progresses.

It is the procedure in the city of Cleveland that on all new work every opening on both the warm air and cold air side of the system, have a cover made for the opening into the room, to eliminate the possibility of other trades people sweeping dirt, plaster, and sometimes two-by-fours down these openings.

The unit itself must be set and erected, controls must be connected, whether it be a thermostat, limit control and air switch or a comprehensive set of controls such as damper controls, zone controls, gas valve and multiple other small items of electrical wiring that have to be taken into account.

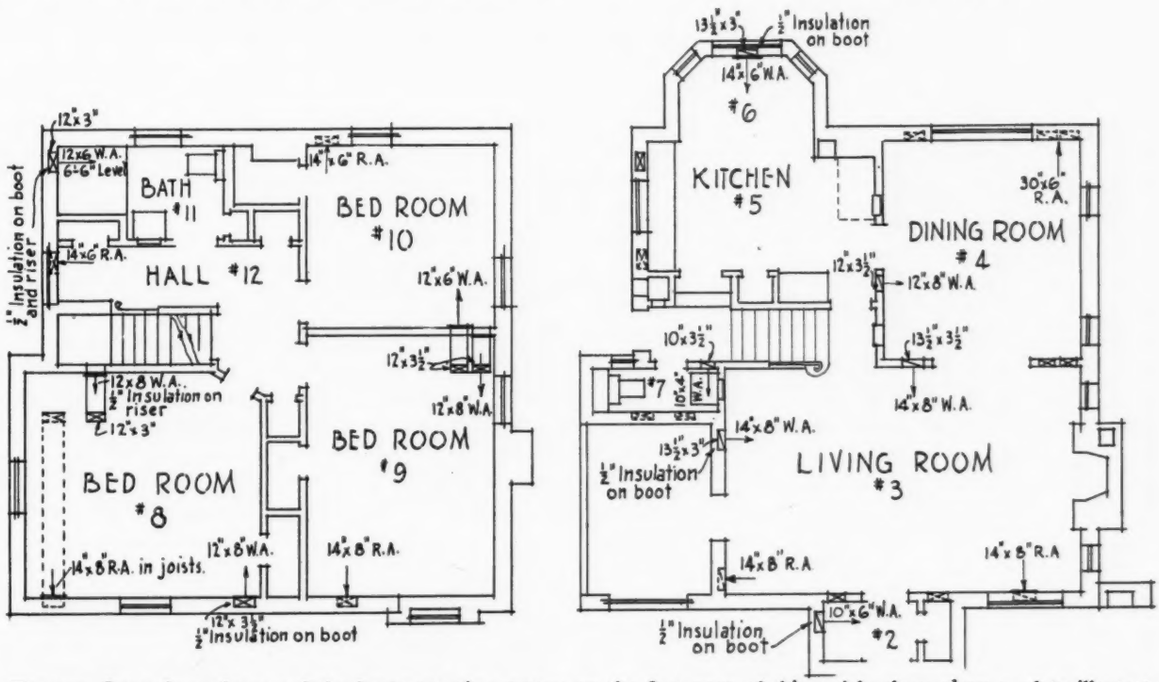
Markup On Apparatus

When the writer discusses the problem of pricing an air conditioning installation with men not allied with our immediate industry and asks them—"What percentage of mark up should a sheet metal man allow for the furnace and register faces," adding that the Sheet Metal Man himself has to actually buy and lay out cold cash for them, the answer usually comes back something like this: "It would be reasonable to expect a sheet metal man to add an additional 20% to 25% over and above his cost of this apparatus because of the fact that though his turn-over of money is only a matter of 30 to 45 days it costs money to do business and his over-head can not be under 20 to 35%."

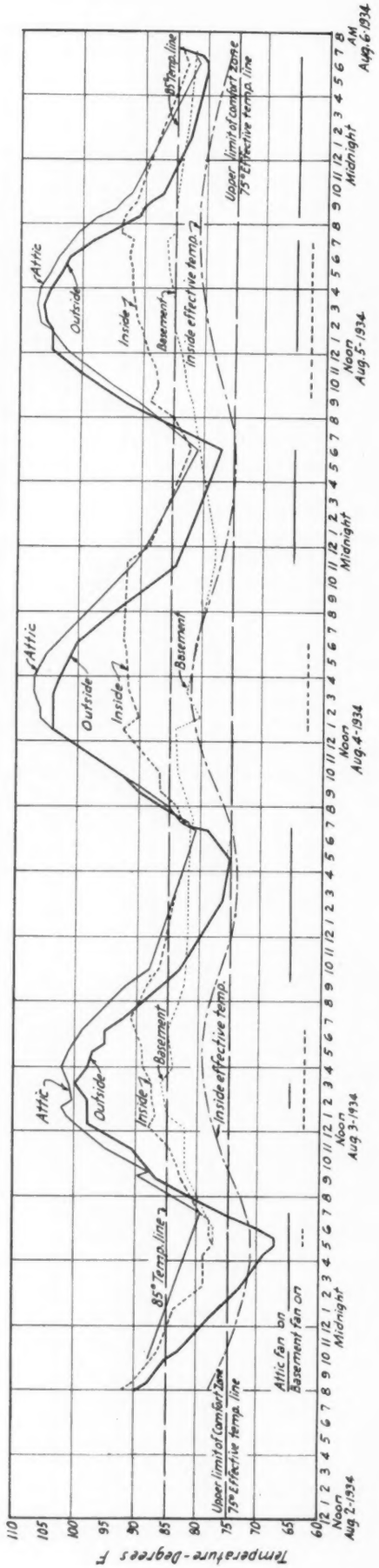
Therefore, with this information, I am prompted to suggest that in addition to using the poundage basis of computing our bid price, we should add to the cost of the unit, registers and grilles and any other such equipment, a nominal over-head and profit on apparatus as a quotation to a contractor or owner.

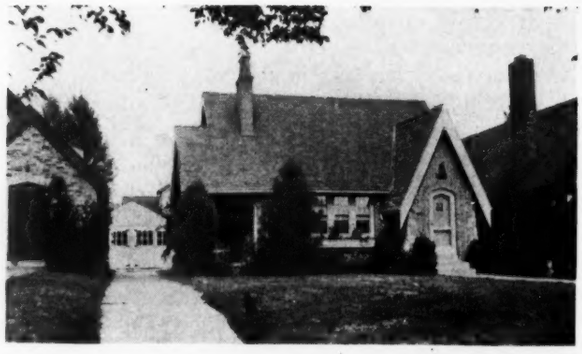
The difference between profit and loss in most sheet metal shops is usually because of a poor understanding of what it costs to do business. Experience in Cleveland has been that with our present labor wage of $1.25 per hour for union mechanics, a sheet metal shop, in order to make a profit, must charge on the basis of poundage at the rate of 35c a pound on small jobs and 30c on large ones.

(*Continued on page* 56)



The two floor plans above and the basement pipe system on the first page of this article show plans used to illustrate Mr. Farris' discussion. The designed system is typical of the practices of the Cleveland installers guided by the Institute.





Cooling Results with an Attic Fan-Furnace Blower Working Together

By M. W. Pehl

Kansas City School of Engineering

"THE proof of the pudding is the eating thereof." This is an old adage that has been applied to many a new idea which has been the means of bringing comfort and health to thousands of persons who are at least willing to be shown.

Fan cooling by means of an attic ventilating fan has been advertised as an inexpensive and practical method of keeping a house reasonably comfortable in hot weather by circulating outside air through the house during the low temperature period of the day.

In order to verify the statements of fan manufacturers and check some of the results obtained at test installations, the writer and one of his students planned and tested the installation of an attic and basement fan ventilating system during the extremely hot summer of 1934, which will stand as a record for high temperatures for some years to come.

This installation consisted of a three-blade propeller type fan mounted on an aluminum frame that was set in the attic window. This fan had a rating of 4,300 C.F.M. at 1,140 R.P.M. and 5,800 C.F.M. at 1,725 R.P.M., and was direct mounted on the shaft of an electric motor of ¼ H.P. capacity with a high and low speed control.

The basement fan was of rotary type that had been installed in the return air duct of the furnace. Provisions had been made to take all the air from the basement when required. This fan has a capacity of 1,000 C.F.M. at 400 R.P.M. and was belt driven by a

◆ ◆

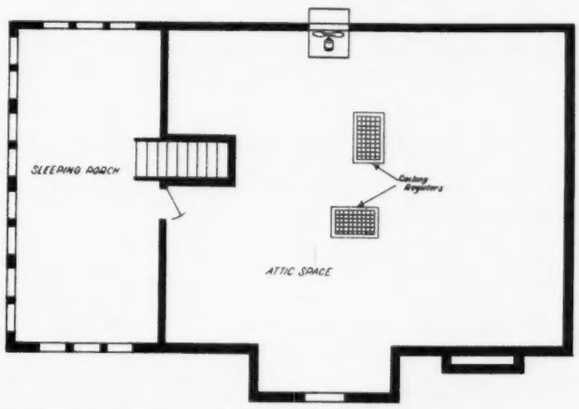
The three-day record at the left shows outside, attic, inside, basement and effective temperatures against operating cycles of both fans. The temperatures charted are well worth study as they show what can be accomplished. Note especially the movements of all inside temperatures when fans are running and when idle.

¼ H.P. motor.

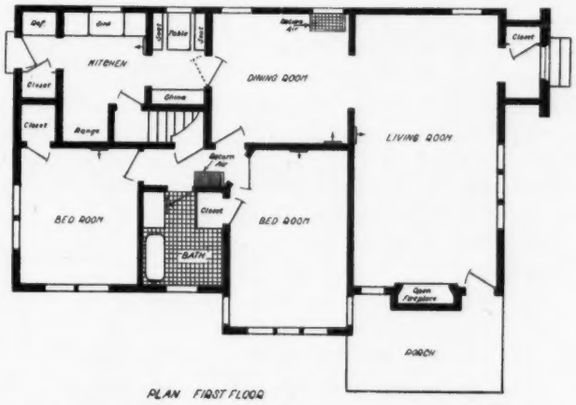
Each of these fans was controlled manually, no attempt being made to control them by a thermostat or a time switch. While temperature charts covering a longer period of time were kept, our special test was of three days' duration: namely, from August 2d starting at 8:00 p. m. and continuing through to August 6 till 7:00 a. m. Each of these three days the outside temperature reached 100 degrees and over.

Test Results

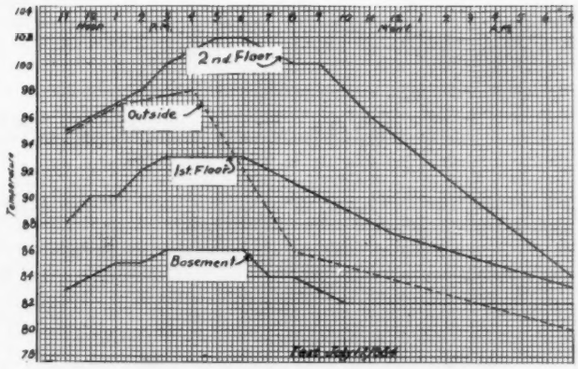
Starting with a temperature of 90 degrees at 8:00 p. m. on August 2, the outside temperature dropped to 67 degrees at 5:00 a. m. The attic fan was started at 1:00 a. m. and kept running until 7:00 a. m. while the basement fan was started at 5:00 a. m. and was run for one hour. The attic fan was again run between 9:00 a. m. and 10:00 a. m. for about half an hour to see what effect this would have on the temperature in the attic. The chart shows the resultant drop in the attic temperature. From 12:15 noon until 6:30 p. m., the basement fan was in operation and this accounts for the rise in basement temperature during this period. Note that when the basement fan was shut off at 6:30 p. m., the inside temperature went up to its highest point of the day. The attic fan was started at 1:30 p. m. and continued to run until 3:00 p. m. with a small drop in attic temperature. From 9:15 p. m. August 3d to 6:45 a. m. August 4th, the attic fan was left running to see how low the temperature could be reduced with the fan running all night. The uniform parallel drop in both inside and attic temperature lines show the result. During this time the basement fan was not in operation.



The attic plan shows the two ceiling registers and location of attic fan at an outside opening. Opening the sleeping porch door and running the attic fan all night gave comfort on the porch.



The first floor plan shows registers through which air from the basement blower was pumped into the rooms. Basement air was used through the blower.



The chart shows first and second floor temperatures in a house without a fan of any kind. Note the high temperatures of the second floor hours after the outside temperature started to drop.

One of the most interesting developments brought out by this test was the fact that at 7:00 a. m. every day all four temperatures plotted seemed to meet at a common point of 82 degrees. The attic temperature line shows a consistent increase in temperature above outside temperature. This is due to the sun effect on the roof, and the lag in time of temperature difference was seldom more than one hour.

It is interesting to note that the basement temperature seldom reached 85 degrees and this fact will, I believe, have a direct bearing on the modern idea of using the basement as a recreation room in the summer if proper air distribution and turbulance can be provided. This should open a good field for repair men, small contractors and air conditioning firms.

House Arrangement

The floor plans of the house are shown with two ceiling registers and fan location in the attic. Louvres were installed in the gable and opposite the fan location so that outside air could be taken in through the louvres or the door leading to the sleeping porch could be opened and a current of outside air circulated in this manner. This brought about the plan to leave the attic door open and keep the attic fan running during the night to provide a movement of air through the sleeping porch and the results were most gratifying.

The test also proves that ceiling registers for ventilation must be of ample size with as little grill work as necessary so the air will have practically no resistance.

In the subsequent test in another house taken the same summer, the temperatures are shown for a period of 20 hours. No fan of any kind was used during this test and the surprising fact was brought out that the temperature on the second floor was close to the 100 mark hours after the outdoor temperature had dropped twelve degrees. This was due to the terrific heat load that had been built up by the sun during the day.

This difference must be taken into consideration on all two or more story buildings when estimating the cooling load factors.

Forced Air Heating Facts From the Research Residence

By S. Konzo
Special Research Associate
Engineering Experiment Station
University of Illinois

Rational Approach to Design of Forced-Air Heating Systems (Part 2)

Introduction

THIS discussion of the method of designing a forced-air heating system was begun in the article appearing in the June, 1936 issue of the AMERICAN ARTISAN. The author continues the discussion in this article.

The general procedure in designing a forced-air heating system may be itemized briefly in the following manner:

a. Determine heat loss from each room in B.t.u. per hour.
b. Locate all warm air supply registers and return grilles on the plans of the house, beginning with the upper story rooms.
c. Sketch in a tentative duct system (single line layout) to connect all the registers and grilles with the central heating unit.
d. Determine the equivalent length of duct leading to each register, allowing 10 diameters of straight pipe as equivalent to each 90-degree elbow, having an inner radius not less than the diameter of the round pipe or the depth of the rectangular pipe.
e. Select a value for the temperature of the air at the furnace bonnet. It is customary to use a value between approximately 150 deg. F. to 165 deg. F. In well insulated structures where a larger number of air recirculations is desired, a lower value for the bonnet air temperature may be found to be desirable.
f. Determine approximate value of temperature reduction in each duct caused by the loss of heat from ducts.

Object

The discussion in this present article will deal with this last item of determining the temperature reduction in ducts as well as with the factors affecting the heat loss from ducts. The discussion may be briefly summarized in the following outline:

a. It will be shown that in a gravity warm-air furnace system the value of the register air temperature is closely related to the weight and volume of air required at each register. A low value of the register air temperature will require a large amount of air.
b. Evidence will be presented to indicate that in a gravity warm-air furnace plant the register air temperatures in any given heating plant are not uniform.
c. It will also be shown that similar conditions exist in the forced-air heating systems.
d. The effect of unequal temperatures in the individual registers in a given heating system is illustrated by an example. The importance of making proper estimates of the register air temperatures is strongly emphasized.
e. The difficulties inherent in attempting to calculate the heat loss from ducts and leaders make it necessary at this time to justify the use of *average* values of the temperature drop in ducts. *Calculated* values are difficult to make and may be considerably in error unless all factors are considered.

Importance of Temperature Loss

a. Significance of Register Air Temperatures in Gravity Systems.

The relationship between the heat available at the registers and the air temperatures at the registers was first discussed in some detail twelve years ago in Bulletin 141 of the Illinois Engineering Experiment Station. Although the discussion at that time was directed towards the gravity warm-air heating system, many of the arguments apply equally well to forced-air heating systems. The following paragraph, excerpted from Bulletin 141, recognizes the significance of register air temperatures in the design of a furnace heating system:

"Apparently any register air temperature falling between the limits of 120 and 220 deg. F. could be used for designing a furnace heating system. While this is theoretically possible, reference to the following equation will show that as the register air temperature is reduced, the weight and also the volume of air required to supply the heat for a given building will increase very rapidly, the converse of this being equally true for an increase in the register air temperature:

$$H = W \times 0.24 \times (T - 70)$$

in which,

H = B.t.u. required per hour for heating the room
W = weight of air circulating, lb. per hour
0.24 = specific heat of air, or the fraction of a B.t.u. required to raise 1 lb. of air 1 deg. F.
T = register air temperature in deg. F.
70 = Mean temperature of room at breathing line, deg. F.

"The values given in Table 1, line 3, represent relative velocities of flow in the return ducts for five different values of the register air temperature. In the case of the warm-air pipes and stacks, however, a correction for the density of the warm air is necessary if velocity comparisons are to be made.

TABLE 1
(From Bulletin 141)
Effect of Various Register Air Temperatures on the Weight of Air Required to Give a Constant Heat Available

Register Air Temperature deg. F.	175	160	150	140	130
Rise (Reg. temp. — Inlet temp.)	105	90	80	70	60
Relative weight of air in terms of weight at 175 deg. F.	1.0	1.168	1.312	1.50	1.75
Per cent increase over weight at 175 deg. F.	0	16.8	31.2	50	75

It may be noted that when the register air temperature is 130 deg. F., the weight of air required to give a constant quantity of heat is increased by 75 per cent over that required for 175 deg. F.

"The selection of a proper air temperature at the registers is fundamental to the correct design and operation of a gravity circulating warm-air furnace heating system."

b. Unequal Register Air Temperatures in Gravity System.

In the case of gravity warm-air furnace systems, a register air temperature of 175 deg. F. was arbitrarily selected as a design temperature, since a higher value was not conducive to good operating conditions and a lower value required larger sizes of leaders and stacks that would make the installation of a leader pipe system in the ordinary house almost prohibitive.

Actual tests made in the gravity furnace system in the Research Residence indicated, however, that

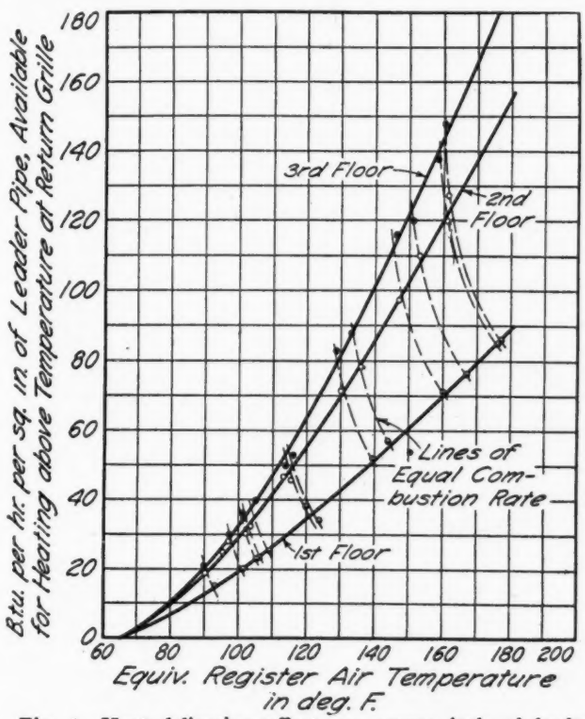


Fig. 1—Heat delivering effect per square inch of leader pipe from Research Residence tests. (Gravity furnace system.)

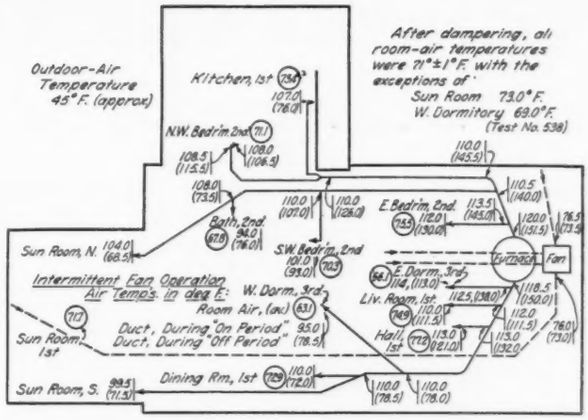


Fig. 2—Branches, mains, register air temperatures, room air temperatures before and after dampering. (Research Residence forced air system.) Note particularly the values for register air temperature. See also Table 2.

although a constant value of the register air temperature was assumed, some differences were found to exist between the temperatures on the first, second, and third stories. The following is from Bulletin 141:

"In Fig. 1 the data for the research residence are plotted and the relations between register air temperature and the heat delivering capacity of 1 square inch of first, second and third-story pipe are shown as very definite curves terminating at 65 deg. F. at which temperature the heat available in the air discharged from the registers would become of zero magnitude. . . . Referring again to Fig. 1 and the light lines connecting corresponding points on the first, second and third-story curves marked 'lines of equal combustion rate,' it is evident that at any given rate of combustion in the furnace the air will be delivered at the three floor levels at three different temperatures. It appears, therefore, that a system may not be designed to operate at the same temperature at all three floors. Thus, if 175 deg. F. is taken as the temperature for the first-story registers, the second and third-floor register air temperatures will (in the residence system) be 160 deg. F. and 157 deg. F. respectively. Uniform register air temperature conditions would require perfect insulation of the stacks and the same temperature at all bonnet collars."

c. Significance of Register Air Temperatures in Forced-Air Systems.

With slight modifications, the discussion of register air temperatures for a gravity furnace system applies equally well to the case of forced-air heating systems. When the forced-air heating system in the Research Residence was designed and installed in 1932, a value of 135 deg. F. was arbitrarily assumed for the average register air temperature. Furthermore, this assumption also tacitly assumed that there would be no variation in the register air temperatures for the different registers in the system. Incidentally, it is of interest to note that a large majority of installations are still being designed in this manner.

Actual observations made on the Research Residence forced-air system disclosed that the register air temperatures were not uniform and that the differences between the temperatures at the individual registers

(*Continued on page* 60)

A Rational Heat Gain Method for the Determination of Air Conditioning Cooling Loads† [Part 3]

By F. H. Faust,* L. Levine* and F. O. Urban,* Schenectady, N. Y.

Heat From Lights and Appliances

HEAT dissipating appliances which give off only sensible heat may be divided into three classes:

1. Those whose electrical watts input are known, or can be read from a nameplate.
2. Those whose electrical watts input may be determined, through brief calculations.
3. Those which have no electrical input.

In the first category may be found such devices as electric lights, toasters, waffle irons, etc., for which the nameplate indicates the electrical power consumption. All of this power is changed into heat and given off to the air in the room. The amount of heat in Btu. per hour thus liberated is equal to 3.4 times the watts input (one watt is equivalent to 3.415 Btu. per hour).

Under the second heading may be included such devices as motors which show on their nameplate a hp. rating but do not give the watts input for that rating. If the motor efficiency is known, the watts input may be calculated from the formula:

$$P = \frac{746\ (hp)}{n} \qquad (7)$$

where

P = motor input, watts.
(hp) = motor load, horsepower
n = motor efficiency (expressed as a decimal).

If there is no way of determining the motor efficiency, then as a fair approximation, the heat gain from such sources may be obtained by using the data in Table 5, multiplying the figures in the table by the motor hp. rating.

The third class of appliances includes items such as ranges, steam tables, coffee urns, uncovered steam pipes, etc., where no electrical power consumption is involved. For such cases it is necessary to make a direct estimate of the heat gain in Btu. per hour. Table 6 gives heat from various types of appliances.

There are some appliances which give off not only sensible heat, but latent heat as well. These will be encountered most generally in industrial applications. Any device which evaporates moisture into the air falls into this category, and the moisture thus evaporated must be included in the calculations. First, calculate the amount of moisture which is evaporated. The latent heat gain from such appliances is then:

$$H_1 = 1060\ M$$

where

H_1 = latent heat of appliance, Btu. per hour.
M = rate of evaporation of water, lb. per hour.
1060 = average latent heat of vaporization of water vapor at air conditioning temperatures.

A pitfall to avoid in this calculation is the inclusion of latent heat from appliances in two different parts of the calculation. Thus, suppose an electric hot plate rated at 500 watts were used to boil water, resulting in the evaporation of a half pound an hour. The total heat dissipated by the hot plate would be $500 \times 3.4 =$ 1700 Btu. per hour. The latent heat given off would be $0.5 \times 1060 =$ 530 Btu. per hour. The thing to note is that the 530 Btu. is included in the 1700 Btu. given off by the hot plate. Thus,

Latent heat from the hot plate = 530 Btu. per hour
Sensible heat from hot plate = 1170 Btu. per hour
Total heat from hot plate = 1700 Btu. per hour

Table 5—Heat Generated by Motors and Motor Generators Operating Continuously

Nameplate Rating in hp.	Heat Gain in Btu per Hr. per hp. Rating: Connected Load in Same Room	Connected Load Outside of Room
⅛ to ½	4250	1700
½ to 3	3700	1150
3 to 20	2950	400

Motor Generators: Nameplate Rating in Kilowatts	Heat Gain in Btu per hr. per kw. Rating
¼ to 3	2800
3 to 5	1300

Table 6—Heat from Appliances

Nature of Appliance	Btu per Hr. Not Hooded	Hooded and Ventilated
Coffee Urns and Percolators		
1 gallon capacity	1000	250
2	2000	500
3	3000	750
4	4000	1000
5	5000	1250
10	16000	4000
Dish Warmers per 10 Sq. ft. of Shelf	6000	
Restaurant Range—4 Burner and Oven	100000	
Residence Electric Range		
Small Burner	3400	
Medium Burner	4100	
Large Burner	7700	
Oven	10200	
Appliance Connection	2200	
Warming Compartment	1000	
Residence Gas Range		
Giant Burner	12000	
Medium Burner	9000	
Pilot	250	
Oven	1000 Btu per cu.ft.of oven volume	

Heat From Ventilation Air

Outdoor air may be introduced to an air conditioned space either by natural and uncontrolled infiltration or by controlled ventilation. Such ventilation air must be cooled to room temperature and dehumidified to room

*Engr., Air Cond. Dept., General Electric Co.

†Presented at the Semi-Annual Meeting of the American Society of Heating and Ventilating Engineers, Toronto, Ont., Can., June, 1935. See ASHVE Journal Section, Heating, Piping and Air Conditioning, August, 1935.

humidity. The sensible and latent heat gains from ventilation air are determined accurately from the two formulas:

$$H_s = \frac{60\ Q}{v}\ 0.24\ (t_o - t_i) \qquad (10)$$

$$H_l = \frac{60\ Q}{v}\ \frac{\omega_o - \omega_i}{7000}\ 1060 \qquad (11)$$

where

H_s = sensible heat, Btu. per hour.
H_l = latent heat, Btu. per hour.
Q = ventilation air rate, cfm.
v = specific volume of ventilation air, cu. ft. per lb. of dry air.
ω_o = vapor density of outdoor air, grains of moisture per lb. of dry air.
ω_i = vapor density of indoor air.

For all practical purposes, these formulas can be simplified to:

$$H_s = 1.04\ Q\ (t_o - t_i) \qquad (10a)$$
$$H_l = 0.66\ Q\ (\omega_o - \omega_i) \qquad (11a)$$

The various terms involved in these two formulas are easily determined. The method of determining the outdoor and indoor dry-bulb temperatures and vapor densities have been described previously under Design Conditions. The quantity of ventilation air, Q, is equal to the specified amount of ventilation air if a ventilation duct leads to the air conditioner. If dependence is placed on natural infiltration to supply outdoor air, Q is the infiltration rate.

Heat From People

The heat given off by persons varies with the degree of activity of the individual and the temperature of the air, as described in Chapter 2 of THE A.S.H.V.E. GUIDE[3]. In most air conditioning applications people are found in one of two general states of activity—either they are seated or standing at rest, moving about only occasionally (as in a home or office); or they are engaged in brisk activity such as walking or dancing (for example, restaurant waiters or night club patrons). For all ordinary cases, the values of sensible and latent heat gain in Btu. per hour per person as given in Table 7 may be used. Consideration should, of course, be given in all cases to the number of people who fall in one category or another.

Table 7—Heat from People (at 80 F.)

1. Average condition (at rest, eating, office work, etc.)		
Sensible heat	220	Btu. per hour per person
Latent heat	180	" " " " "
Total	400	" " " " "
2. Medium rate of exertion (restaurant waiters, average dancing, etc.)		
Sensible heat	230	Btu. per hour per person
Latent heat	420	" " " " "
Total	650	" " " " "

Selecting the Time of Day for Calculation

In selecting the time of day for calculations, one must distinguish between two general types of application. The first class includes all applications which do not have an unusually large and sharply variable heat gain from people or appliances, such as residences, offices, some types of retail shops, etc. The second class would include all applications which do have a large heat gain from people and appliances, varying sharply at certain hours of the day, such as restaurants, night clubs, theatres, funeral parlors, etc.

Cases in the first category may be handled quite simply and with reasonable accuracy. The time of maximum heat gain in such cases is dependent upon the climatic factors and degree of exposure of the space being air conditioned. It does not depend so much on variables like occupancy and heat producing appliances. Because of this it has been possible to make a study of the probable time of maximum heat gain in such cases with various exposures, and reach substantially accurate conclusions beforehand. The results of this study are given in Fig. 6 and Table 8. It is necessary merely to select from Fig. 6 that room which has the same exposure as the room being calculated,, and then refer to Table 8 to find the correct time of day for that room.

It is not intended that Fig. 6 and Table 8 should be used blindly. This standard method was worked up on the basis that the rooms under consideration were approximately square; that outside walls were exposed

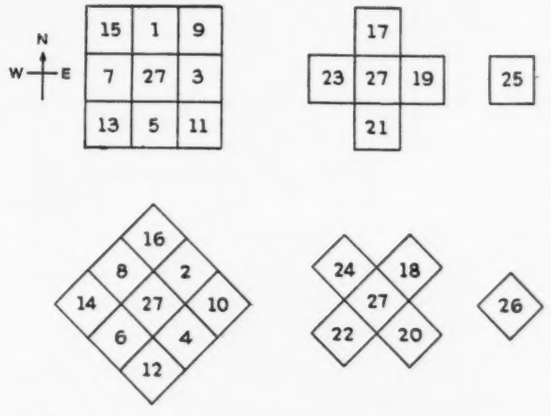


Fig. 6—Typical room exposures (Use with Table 8 to determine time of maximum cooling load)

Table 8—Time of Maximum Cooling Load for Rooms with Different Exposures

(To be used with Fig. 6)

Room Number from Fig. 8	Number of Walls Exposed	Exposed Walls	Awnings on Windows		No Awnings on Windows	
			Occupied Space Above	Roof or Attic Above	Occupied Space Above	Roof or Attic Above
1	1	N			2 p.m.	2 p.m.
2		NE			2	2
3		E	2 p.m.	2 p.m.	9 a.m.	9 a.m.
4		SE	1	1	10	10
5		S	2	1	1 p.m.	1 p.m.
6		SW	3	2	4	3
7		W	3	3	4	4
8		NW	4	3	5	4
9	2	N E	2	2	9 a.m.	9 a.m.
10		NE SE	2	1	9	9
11		E S	2	1	10	10
12		SE SW	3	2	3 p.m.	3 p.m.
13		S W	3	2	3	3
14		SW NW	3	3	4	4
15		W N	3	3	4	4
16		NW NE	4	3	5	5
17	3	W N E	4	3	4	4
18		NW NE SE	3	3	4	4
19		N E S	2	2	10 a.m.	10 a.m.
20		NE SE SW	3	2	3 p.m.	3 p.m.
21		E S W	3	2	3	3
22		SE SW NW	3	3	4	4
23		S W N	3	3	4	4
24		SW NW NE	4	3	4	4
25	4	S W N E	3	2	3	3
26		SW NW NE SE	3	2	4	4
27	None				2	2

to the sun, and not shaded by other buildings; that outside walls had one or more windows; that the heat from occupants and appliances was small as compared with the heat from other sources. Consequently, this data does not apply exactly to rooms which do not conform to these conditions, although it is quite correct for rooms which do not deviate too widely from these specifications.

As an example of the use of Fig. 6 and Table 8, let us consider a room which has a south and west exposure, no awnings on the windows, and an occupied space above, such as might occur in a modern office building. The sun effect on the south wall and windows reaches a maximum at noon. Sun effect on the west wall and windows reaches a maximum at 4 p. m., and the value thereof is greater than for the south wall. The outdoor temperature, and consequently the tendency to gain heat by conduction through practically all walls, ceilings, floor, etc., is greatest about 3 p. m. The heat from outdoor air also reaches a maximum about 3 p. m. From this it is apparent that the effects at 3 p. m. or thereabouts, will overshadow the effects at noon. Furthermore the sun effect on the west wall at 3 p. m. will be almost as great as at 4 p. m. Consequently 3 p. m. should be the proper time for which to make the calculation. It will be noted that room 13 in Fig. 6 fulfills the specifications laid down above, and from Table 8 the time of maximum heat gain is listed as 3 p. m.

Now suppose that this same room were located under a roof or a hot attic. The sun effect above the room would be a large factor and would reach a maximum at noon, just the same as on the south wall. The effect of this would be to make the maximum total heat gain come somewhat earlier than before—probably about 2 p. m. instead of 3 p. m. This is shown in Table 8.

Let us suppose now that there is under consideration a restaurant doing its greatest business at dinner, and therefore having its maximum occupancy between the hours of 6 and 8 p. m. The people would naturally supply a considerable proportion of the total heat gain and would probably control the time of day when the total heat gain is maximum. Hence, it is not correct to make the calculations for 2 or 3 p. m., and then add the heat gain from occupants which occurs at a later hour. On the other hand, it would not be quite accurate to make calculations of all components for 6 or 7 p. m., because of a factor which has been mentioned previously, but not discussed, namely, the effect of time lag or retardation of the heat flow through walls. This factor will be discussed in more detail later. The correct solution in the case of a restaurant of this nature would be to calculate the heat gain from sun effect through windows, lights and appliances, ventilation air and occupants at 6 or 7 p. m. (of course, in the particular case being discussed there would be no sun effect through windows at this late hour), and to add to them the conduction through walls and sun effect through walls calculated for about 4 p. m. or earlier.

In case of doubt as to the proper time to use, the following procedure is recommended:

1. Calculate the maximum value which each component attains during the day, assuming that there is no time lag in the heat transmission through walls.
2. Note the hours at which these peaks occur.
3. Consideration should be given to time lag phenomena in walls, in a manner to be discussed later.
4. Select the probable time of maximum total heat gain from an analysis of the above data.
5. Where the economics of the application warrants the additional time required, an hour by hour calculation of the heat gain may be made.

Effect of Heat Storage in the Walls

Very little has been said thus far about the subject of heat storage in walls, yet it would seem that it must certainly have some effect on the heat gain of a structure. What, then, is the justification for ignoring it in the method of calculation which has been described? The answer is that this effect has not been ignored, but its discussion has been deferred in order to not complicate the picture unduly. Actually, in a great many cases the effect of heat storage in walls may be ignored without creating a serious error in the calculations. Whether this effect may or may not be ignored depends largely on the relationship between the magnitudes of the conduction and sun effect through walls and the other components of the heat gain. If the two former components are predominant, then it may be desirable to take account of the effect of heat storage. On the other hand, if these two components are small as compared with the rest of the heat gain, the neglect of heat storage phenomena will produce no serious error.

The method of calculating conduction and sun effect through walls, described, has been compared with some very accurate tests[10] conducted a few years ago on walls having various heat capacities, and has been shown to give highly accurate results for walls which have heat capacities comparable to those found in ordinary building construction. For walls having abnormally high capacity the calculations give results which are slightly on the conservative side. This comparison demonstrated that the heat capacity of normal walls has relatively little effect on the amount of heat transmitted through them, but it does give rise to a time lag of one hour or more, depending on the construction.

Until more complete experimental evidence is available on the difference of time existing between the manifestation and maximum outdoor effects and maximum heat gain from walls of various building materials, and on the amount of reduction in total heat conducted on account of the storage effect, the following procedure is recommended:

1. Calculate the heat from sun effect through windows, appliances, lights, ventilation air and people on the basis of temperatures, sun effect factors, and other conditions actually existing at the time of maximum total heat gain.
2. Add to the above conduction through walls and sun effect through walls calculated on the basis of temperatures existing from 3 to 6 or more hours earlier in the day than the time at which the maximum total heat gain occurs. Reference may also be made to Chapter 8 of THE A.S.H.V.E. GUIDE[3] for time lag factors.

Unusual Sources of Heat Gain

The obvious sources of heat which have been discussed above are sometimes supplemented by hidden and unexpected sources, the possibilities of which must not be overlooked. One fairly obvious one is the con-

(*Continued on page 64*)

[10]Heat Transmission as Influenced by Heat Capacity and Solar Radiation, by Houghten, Blackshaw, Pugh and McDermott, A.S.H.V.E. TRANSACTIONS, Vol. 38, 1932, p. 231.

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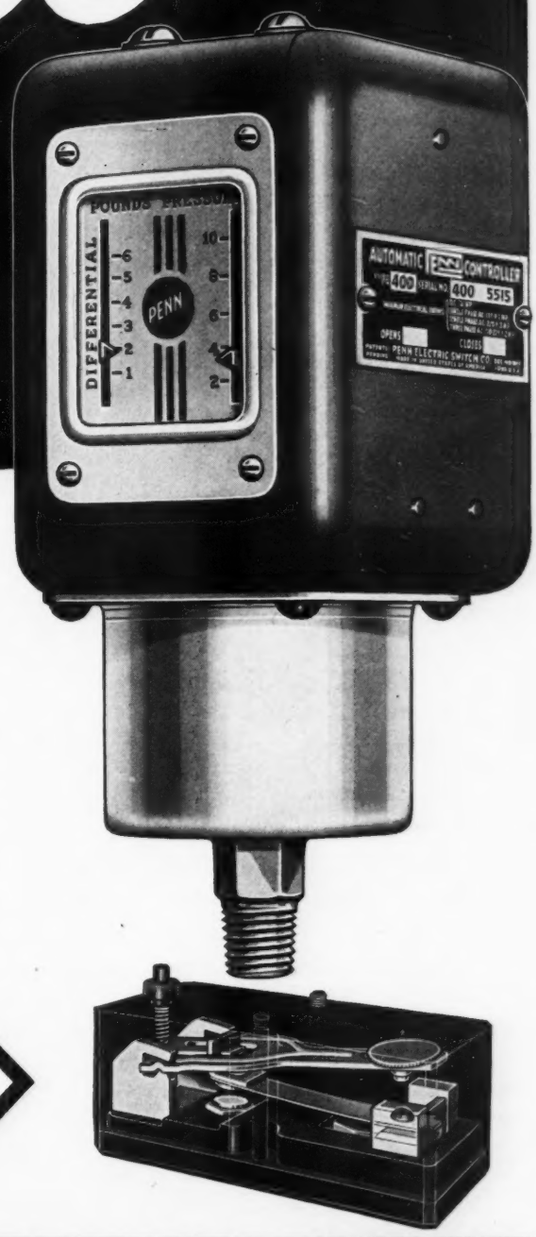

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Physical Factors Affecting Comfort* [Part 2]

By A. P. Kratz
Research Professor
Engineering Experiment Station
University of Illinois

Temperature Gradients in Rooms

IN addition to the effect of cold walls, variations in temperature of the air at different levels in the room may still further operate to discount the value of the reading of a thermometer as a reliable index of comfort. The most common location for such a thermometer is on an inside wall at a height of about 5 feet from the floor. If the temperature of the air is not uniform from the floor to the ceiling, the warmest air will almost invariably be found near the ceiling. Hence, the reading of the thermometer may indicate a temperature sufficiently high for comfort while the greater part of the body may be surrounded by air at a temperature too low for comfort. This is particularly true for individuals seated.

Non-uniform temperatures at the different levels in a room is not confined to one type of heating plant alone,

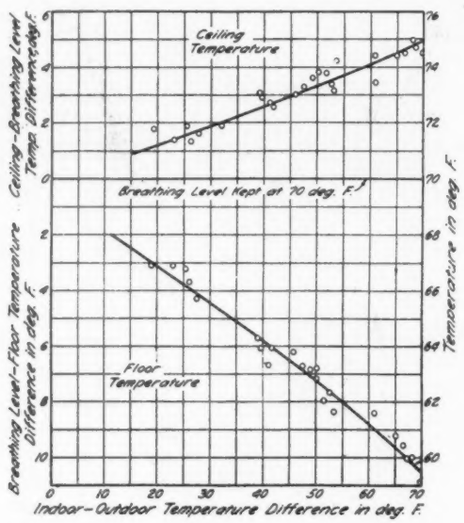


Fig 3—Curves of floor, breathing level, and ceiling temperature for living room in research residence, second installation. (From Univ. of Ill., Eng. Exp. Sta. Bulletin No. 189, Fig. 21.)

but is more or less common to all types. Fig. 3 shows results obtained from a well designed gravity warm-air system in which the number of air recirculations varied from 1.8 in mild weather to 3.0 in zero weather.

It may be noted that with zero weather outdoors, or with an indoor-outdoor temperature difference of 70 deg. F. the thermometer at the 5-ft. level indicated a comfortable temperature of 70 deg. F. while the temperature of the air near the floor was approximately 60 deg. F. Hence, the body of a person standing would be surrounded by air at a mean temperature of 65 deg. F. and sitting, at a mean temperature somewhat less than 65 deg. F. In this case the room was not definitely uncomfortable for some people, but was so for others.

By increasing the temperature to 73 at the 5-ft. level the room could be made definitely comfortable. This may be regarded as a border-line case in which the inside surfaces of the exposed walls were at approximately 60 deg. F. It may also be noted that in milder weather

Fig. 4—Six-section, 26-in. height, 5-tube, radiator in cold room testing plant.

the temperature difference between the floor and the 5-ft. level decreased rather rapidly.

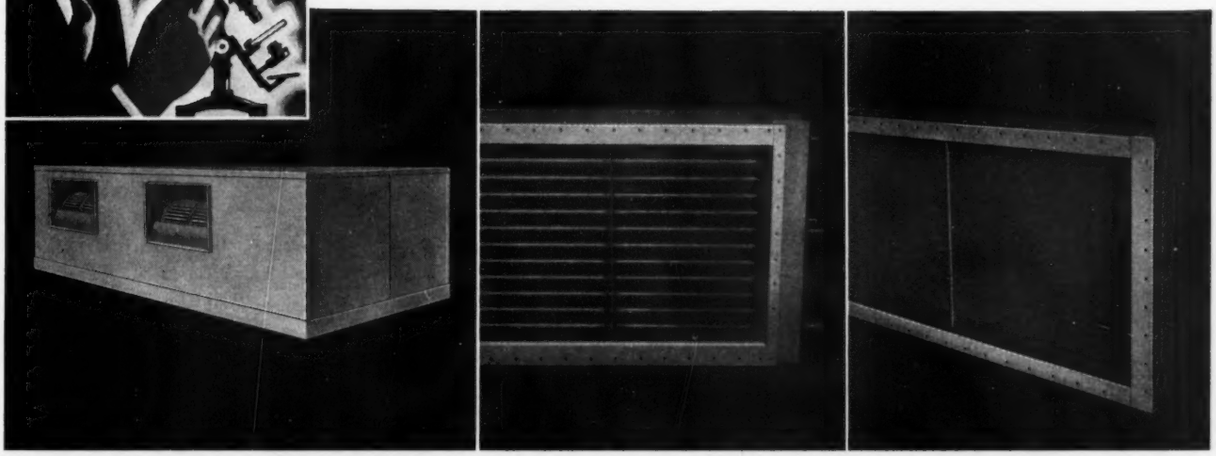
Two characteristic types of radiators are shown in Fig. 4 and 5. Fig. 4 represents a 5-tube radiator, 26-in. high, rated at 21 sq. ft. of radiation. Fig. 5 represents a wall type of radiator, also rated at 21 sq. ft.

The temperature variations from the floor to the ceiling and the steam condensations, obtained with the tubular radiator located in the usual position under a window and with the wall radiator located in two positions, are shown in Fig. 6. The tubular radiator produced a temperature of only 55 deg. F. at the floor with

Fig. 5—Three-section, 21-sq. ft. wall type radiator located near the floor in cold room testing plant.

*Paper presented at the University of Illinois Conference on Air Conditioning, Urbana, Ill., May 4 and 5, 1936.

What to look for-



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70 deg. F. at the 5-ft. level and 77 deg. F. at the ceiling. Hence the living zone, or the portion of the room below the 5-ft. level was uncomfortably cold, although the thermometer at the 5-ft. level indicated comfort.

Using the wall type of radiator with the same rated heating surface in a similar position under the window the room was heated to 73 deg. F. at the 5-ft. level and 65 deg. F. at the floor. When the surface of this radiator was decreased so that the temperature at the 5-ft. level was 70 deg. F., comparable with that obtained with the tubular radiator, the temperature near the floor

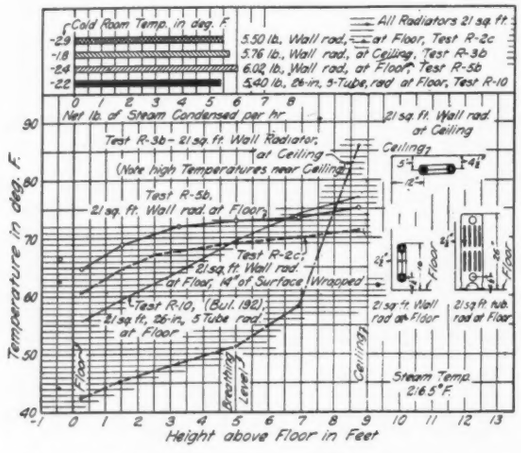
Cold Room Temp. in deg. F.
All Radiators 21 sq. ft.
5.50 lb., Wall rad., at Floor, Test R-2c
5.76 lb., Wall rad., at Ceiling, Test R-3b
6.02 lb., Wall rad., at Floor, Test R-5b
5.40 lb., 26-in., 5-Tube, rad. at Floor, Test R-10
Net lb. of Steam Condensed per hr.
Test R-3b - 21 sq. ft. Wall Radiator, at Ceiling
(Note high Temperatures near Ceiling)
Test R-5b, 21 sq. ft. Wall rad. at Floor
Test R-2c, 21 sq. ft. Wall rad. at Floor, 14" of Surface Wrapped
Test R-10, (Bul. 192), 21 sq. ft. 26-in., 5 Tube rad. at Floor
21 sq. ft. Wall rad. at Ceiling
21 sq. ft. Wall rad. at Floor
21 sq. ft. tub. rad. at Floor
Steam Temp. 216.5° F.
Floor
Breathing Level
Ceiling
Temperature in deg. F.
Height above Floor in Feet

Fig. 6—Room temperature gradients and steam condensing rates for unenclosed radiators in cold room testing plant. (From Univ. of Ill., Eng. Exp. Sta. Bulletin No. 223, Fig. 16.)

was 60 deg. F. as compared with the 55 deg. F. obtained with the tubular radiator. The temperature in the whole of the living zone was higher than that produced by the tubular radiator, while the steam condensation was practically the same. Hence, it is evident that the temperature distribution in a room is greatly

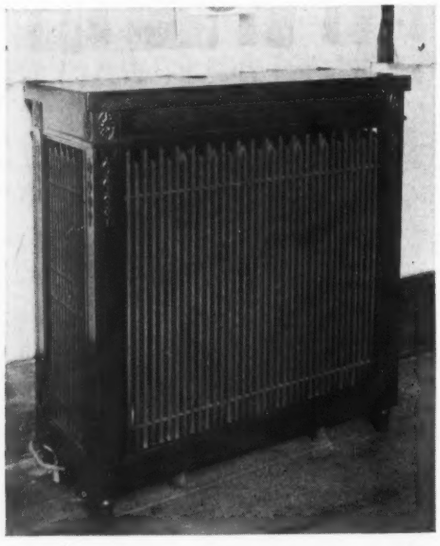

Fig. 7—Enclosure No. 3 Tested in cold room testing plant.

influenced by the type and location of the heater, and that a long, low, and flat radiator is more conducive to comfort than a short, high, and comparatively thick one.

As a further illustration of an extreme case, Fig. 6 shows also the temperature gradient obtained with the wall radiator located horizontally just below the ceiling. In this case the temperature near the floor was 42 deg. F., that at the 5-ft. level only 51 deg. F.; and 3 in. below the ceiling it was 86 deg. F. Within ¼ in. of the ceiling a temperature of 103 deg. F. was indicated. From the standpoint of satisfactory heating these conditions are intolerable.

Radiator Covers

Many means have been adopted to improve both the appearance and the performance of radiators by adding various types of shields, covers, and enclosures. Two of the latter will be considered here as being more or less characteristic. Fig. 7 shows one of the more open types of enclosures, and Fig. 8 the room temperature gradient obtained when this enclosure was used in connection with the tubular radiator shown in Fig. 4. The temperature gradient for the unenclosed radiator is also given for the purpose of comparison.

In this case the use of the enclosure resulted in a higher temperature, and hence more comfortable conditions in the living zone; and in lower temperatures at the ceiling than those obtained with the unenclosed

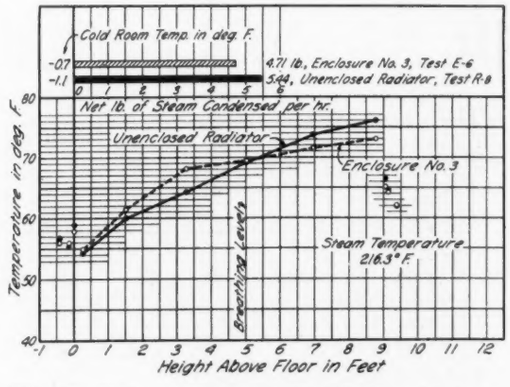
Cold Room Temp. in deg. F.
4.71 lb., Enclosure No. 3, Test E-6
5.44, Unenclosed Radiator, Test R-9
Net lb. of Steam Condensed per hr.
Unenclosed Radiator
Enclosure No. 3
Steam Temperature 216.3° F.
Breathing Level
Temperature in deg. F.
Height Above Floor in Feet

Fig. 8—Room temperature gradient and steam condensing rate for radiator enclosure No. 3. (From Univ. of Ill., Eng. Exp. Sta. Bulletin No. 192, Fig. 24.)

radiator. Furthermore, these results were obtained with less steam condensation in the case of the enclosed radiator. Thus this type of enclosure proved to be both effective and economical.

Fig. 9 shows a type of enclosure with restricted air inlet and outlet, and Fig. 10, the results obtained with this enclosure. In this case, while the enclosed radiator showed less steam condensation than the enclosed, no improvement in the temperature gradient was obtained, and the enclosed radiator failed to raise the temperature at the 5-ft. level to the 70 deg. F. obtained with the unenclosed radiator. The temperature at the 5-ft. level could have been increased by increasing the size of the radiator, but no improvement in the temperature gradient would have resulted. Hence, this type of enclosure can not be regarded as either effective or economical.

From the preceding discussion it may be concluded that a thermometer placed at the 5-ft. level may give an incorrect indication of the degree of comfort experienced in the room, and that while a certain amount of deviation from the true index is characteristic of nearly

(*Continued on page* 66)

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There Should Be No Air Leakage Past the Filters

AT one or two of the state association meetings this year, interesting discussions were introduced from the floor dealing with the subject of properly sealing air filters in blower units, particularly the package units now popular, for the purpose of preventing any air by-passing the filter and entering the warm air supply system, carrying dirt, dust and lint.

Engineers at the conventions conducting air conditioning discussions pointed out that even a small crack between filter cells or between the filter cells and the housing, permits passage of such a volume of air that the cleanliness of the system is seriously disarranged and, of more importance, that as the filters load up with dirt, more and more air tends to by-pass the filter because there is no resistance through the crack. The result is that more and more air enters the house in a dirty condition as the length of filter use increases.

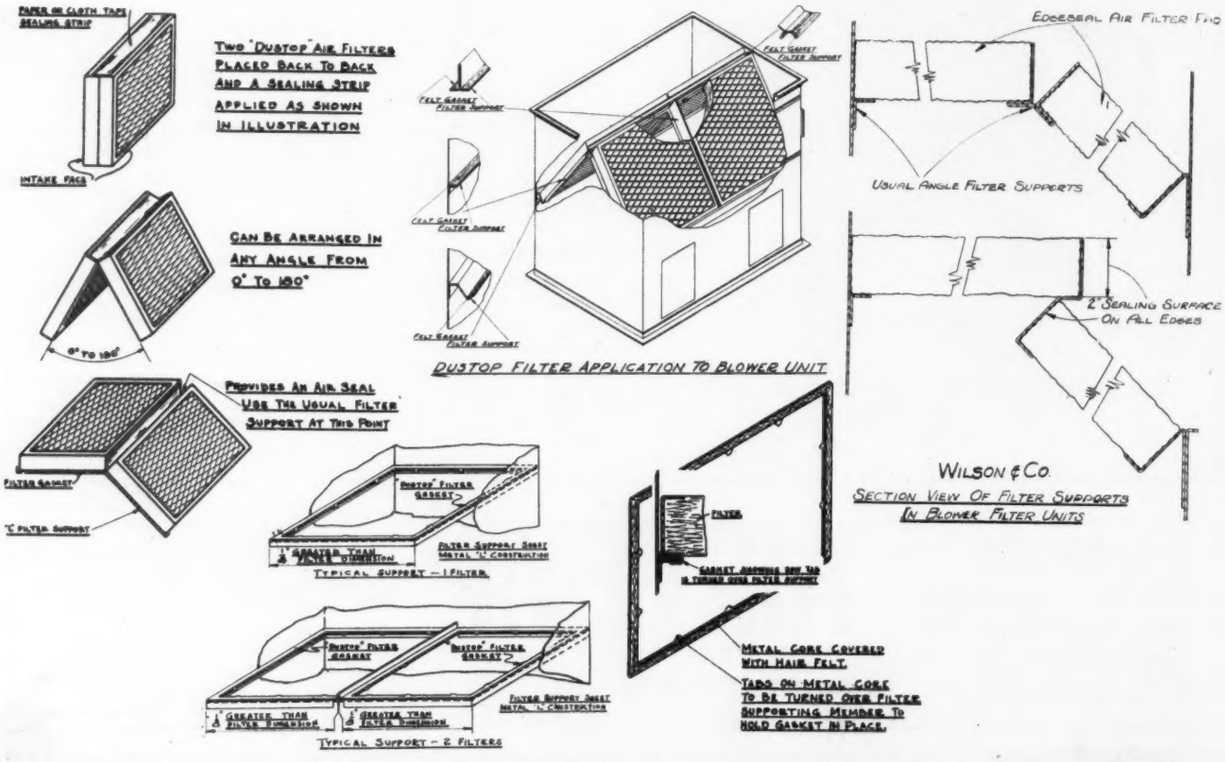
One or two of the filter manufacturers have recently given serious consideration to this particular problem as the result of which these manufacturers have issued bulletins explaining the seriousness of the situation and furnishing recommendations for eliminating the problem.

The Owens-Illinois Glass Co., Industrial Materials Division, Toledo, Ohio, and Wilson & Co., Chicago, both manufacturers of filter cells, have compiled their investigations and recommendations in the form of bulletins available to contractors.

The Owens-Illinois Company has entitled their Bulletin "The Mounting of the Air Filter in the Equipment of the Industry," and in the explanatory text says: "This situation has been gradually developing and warrants far more serious consideration than it has been given in most cases. We have investigated a number of complaints to the effect that a considerable amount of dirt was being carried into the rooms of the house, and in every case we have found excessive by-passing of air around the filters. We have found that in a large number of instances, filters are mounted so poorly as to permit the by-passing of a very large percentage of unfiltered air.

"In recognition of the necessity for establishing a tight seal between the filter and its frame and between filter cells, we introduced a simple type of gasket which is firmly affixed to the frame and having a resilient surface against which the edges of the filter can be sealed. In view of the seriousness of the situation, we have determined to supply these gaskets at actual cost, and we strongly urge that the manufacturer and the contractor utilize these gaskets or some similar measure in order to alleviate the condition.

(*Continued on page 72*)


Two "Dustop" Air Filters Placed Back To Back And A Sealing Strip Applied As Shown In Illustration
Can Be Arranged In Any Angle From 0° To 180°
Provides An Air Seal Use The Usual Filter Support At This Point
Dustop Filter Application To Blower Unit
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Usual Angle Filter Supports
2" Sealing Surface On All Edges
Wilson & Co.
Section View Of Filter Supports In Blower Filter Units
Typical Support – 1 Filter
Typical Support – 2 Filters
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Composite drawing showing suggestions of Owens-Illinois Glass Co. and Wilson & Co., for sealing filters to prevent any air leaking by without being cleaned.

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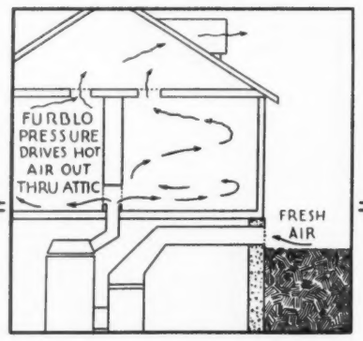

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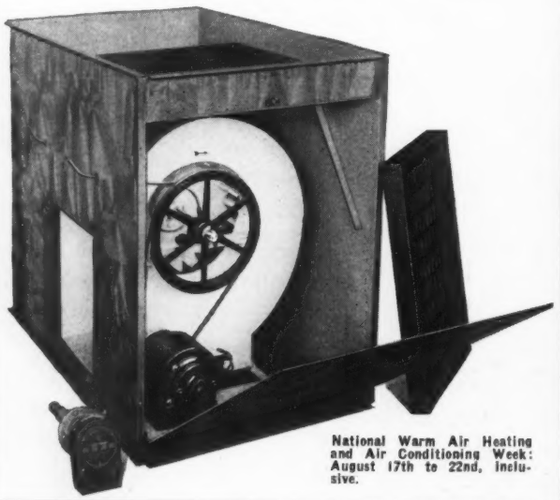


National Warm Air Heating and Air Conditioning Week: August 17th to 22nd, inclusive.

Cooling With City Water

(Continued from page 31)

water with a small amount of coil surface, or by a small amount of water in connection with a large amount of coil surface. Furthermore, the resistance to the flow of air increased rapidly as the amount of surface, or number of rows of coil increased. In addition to the possible limit imposed on the air delivery by the higher resistance, the use of a large amount of surface has the further disadvantage of high first cost. On the other hand, the use of a small amount of coil surface has the disadvantage of high operating cost due to the amount of water used. Under these conditions a compromise is necessary. In the case of the Research Residence, this was effected by selecting 8 rows of coils. As shown by the water rate curve in Fig. 8, this determined a water rate such that a decrease of one or two rows would

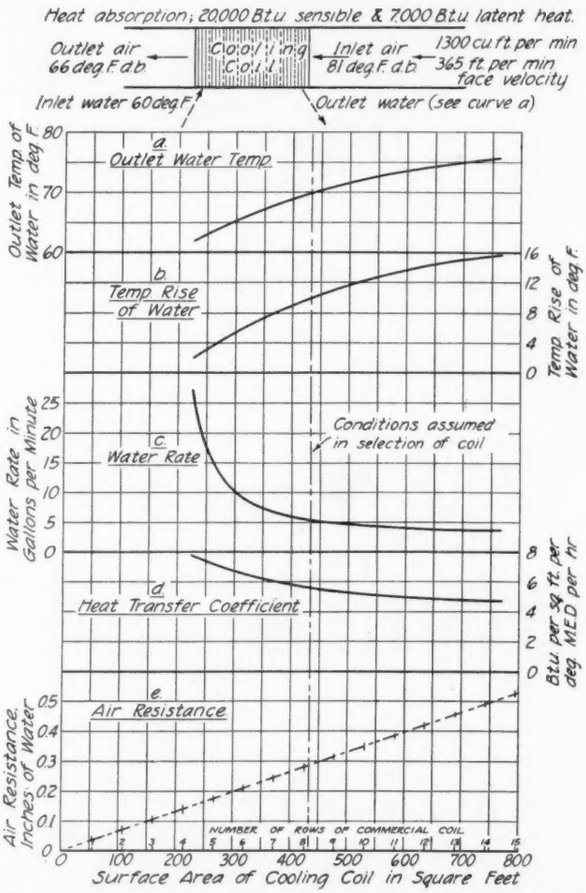
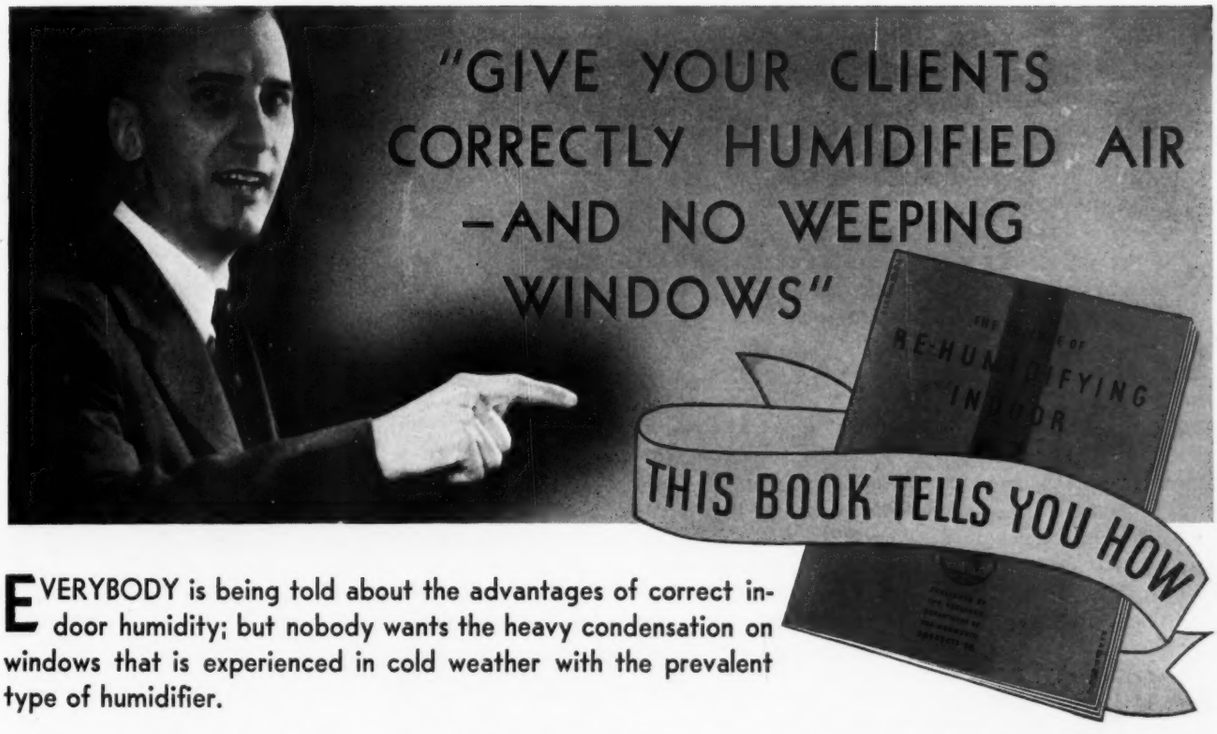

Heat absorption; 20000 Btu sensible & 7000 Btu latent heat.
Outlet air 66 deg F. d.b.
Inlet air 81 deg F. d.b.
1300 cu ft per min
365 ft per min face velocity
Inlet water 60 deg F.
Outlet water (see curve a)
a. Outlet Water Temp.
b. Temp Rise of Water
c. Water Rate
Conditions assumed in selection of coil
d. Heat Transfer Coefficient
e. Air Resistance
Outlet Temp of Water in deg F.
Temp Rise of Water in deg F.
Water Rate in Gallons per Minute
Btu per sq ft per deg M.E.D. per hr
Air Resistance, Inches of Water
NUMBER OF ROWS OF COMMERCIAL COIL
Surface Area of Cooling Coil in Square Feet

Fig. 8—Computed performance characteristics for one type of cooling coil

have resulted in an appreciable increase in water consumption, while an increase of one or two rows would not have resulted in an appreciable decrease in water consumption.

The resistance offered by the coil itself to the flow of water was only 0.5 lb. per square inch as shown in Item 20 of Table 1. The drop in pressure from the city main to the entrance of the coil, however, was approximately 35 lb. per square inch through the ¾ in. line from the main to the coil. This loss in pressure may in some cases be the limiting factor in determining the amount of



EVERYBODY is being told about the advantages of correct indoor humidity; but nobody wants the heavy condensation on windows that is experienced in cold weather with the prevalent type of humidifier.

Automatic June—the Hydro-Metric Humidifying System—regulates humidity according to outside weather conditions, puts re-humidifying indoor air on a scientific basis. It controls humidification within the limits of window condensation in cold weather and provides sufficient evaporating surface for ample humidification in mild weather when bonnet temperatures are low.

MANUFACTURERS—JOBBERS—DEALERS

Automatic June opens a new era in automatic humidification of indoor air. It makes it possible to attain results that were never before attempted, to realize aims that hitherto have been only vaguely understood. Home owners are waiting for this system which is complete and automatic. Automatic June presents new and greater sales possibilities. It yields considerably the largest dollar profit of any humidifying equipment.

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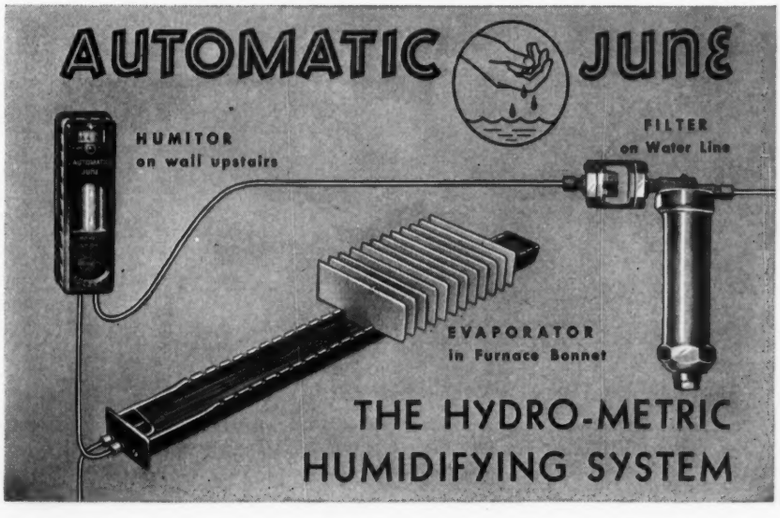
231 E. 131st St. Cleveland, Ohio



Send for it today!

Written in simple understandable language, this book just off the press, will give you, in not more than two hours time, a clear picture of the process of re-humidifying indoor air scientifically. Shown by charts in colors. It tells how outdoor temperature influences indoor humidity . . . How to maintain ample humidity in mild weather . . . How to produce adequate humidity in cold weather without condensation on windows and walls . . . and many other vital facts.

Send for this new book, "The Science of Re-Humidifying Indoor Air," together with literature describing Automatic June, the Hydro-Metric Humidifying System, and particulars of the Automatic June proposition.

THE MONMOUTH PRODUCTS CO.
231 E. 131st St., Cleveland, Ohio

Please send me descriptive literature on Automatic June and book, "The Science of Re-Humidifying Indoor Air."

Name .....

Business .....

Address .....

City ..... State .....

water available for cooling purposes. The estimated resistance to flow of air of the 8 row coil was 0.29 in. of water.

Under normal conditions of winter operation, the total resistance of the system, including friction and shock losses, was 0.18 in. of water, and the fan as installed delivered 1675 cu. ft. of air per minute. For the summer work, however, in order to facilitate testing, particularly in connection with the measurement of the quantity of air delivered, the cooling coil was located in a by-pass in the main return air duct, and the two auxiliary returns were blocked, thus causing all of the return air to pass through the coil and the single main return duct. In addition, the delivery ducts to the sun room and third story were blocked, and it was necessary to readjust the dampers in the remaining delivery ducts in order to balance the cooling on the first and second stories. These changes had the effect of increasing the total resistance of the system without the coil to a value of 0.28 in. of water with 1347 cu. ft. of air flowing per minute. As shown in Item 24, Table 1, the measured resistance of the dry coil with this amount of air flowing was 0.23 in. of water. The latter was greater than the total resistance of the system during winter operation, and was comparable with that of the system without the coil in the case of summer operation. The total resistance of the system with the coil in place was 0.51 in. of water. Under these conditions it was found necessary to install a larger fan for the summer work.

When the surface of the coil became wet with water condensed from the air, the measured resistance of the coil alone increased from 0.23 in. of water to 0.28 in. of water; or 22 per cent. With the speed of the fan maintained constant, the increase in resistance resulting from the collection of moisture on the coil surfaces was sufficient to cause variations in the amount of air flowing depending on the amount of surface wetted. The amount of air delivered through the dry coil was 1347 c.f.m., and with maximum condensation occurring it was 1277 c.f.m.; or a reduction of 5.2 per cent.

If the cooling coil had been located in the return duct just above the fan inlet without further changes in the winter system, it is possible that the total resistance would have been increased to only 0.41 in. of water instead of to 0.51 in. of water. Even this, however, is more than double the normal resistance for winter operation, and it is doubtful whether the fan used for winter operation could have been retained. In cases where the temperature of the available service water is above 55 F., the resistance of the coils and the possibility of the need for a larger fan for summer cooling than for winter heating should be given careful consideration in the design of forced-air systems that are to be used for both summer cooling and winter heating.

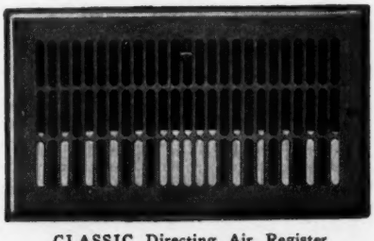
Summary of Seasonal Results. Table 3 gives a summary of the total quantities obtained for the season of 1935. The total of 1081.8 degree-hours above 85 F. indicates that this season was mild as compared with those for 1934, 1933, and 1932, for which the degree-hours above 85 F. were 2657.5, 2309.3 and 1470.7 respectively. This was caused by the comparatively small number of days on which the outdoor temperature rose above 90 F. The hours above 85 F. for this season were 322.6 as compared with 481.5, 493.2 and 329.1 for 1934, 1933

AUER Air Conditioning REGISTERS

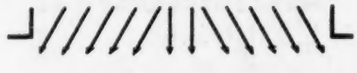
Add to the Results of *Any* System

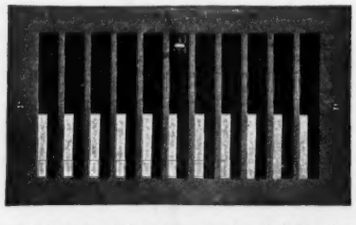
Satisfaction in air conditioning equipment is highly dependent on correct details of register design. In Auer directional air-flow registers, the blades (furnished for airstream in any direction) are ample in size and positive in position. Blades are either fixed at the factory or adjustable on the job. Unusual structural strength with maximum free circulation area. Auer Quality Registers and Grilles are expertly designed and built—to enhance the effectiveness of *any* air conditioning system.

Write for Air Conditioning Register Catalog 36A.



CLASSIC Directing Air Register (Adjustable blades).





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AUER DISTINCTIVE REGISTERS & GRILLES For Air Conditioning *and* Gravity

KIND OF FILTER

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"V" ANGLES GET THE DIRT!

MANY HOMES, new and old, today are being air conditioned. To meet the demand for efficient and inexpensive air cleaning in these installations, American Radiator Company developed the new Arco Air Filter. Its many outstanding advantages are making it a favorite for replacement. And many manufacturers of air conditioning have adopted it as standard equipment.

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Cellular passages, with a 90 degree "V" angle changes direction of the air and scrubs it against the sticky walls, removing dust and other foreign matter. The efficiency of the filter keeps building up, because the dust that is collected absorbs the adhesive and catches more dust. Resistance builds up slowly and uniformly during the life of the filter.

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ARCO AIR FILTERS

and 1932, while the hours above 90 F. were only 82.5 as compared with 224.1, 208.4 and 121.8 respectively for the previous seasons. The severity of the season as measured by degree-hours is apparently determined largely by the total number of days on which the maximum temperature exceeds 90 F., since the higher numbers of degree-hours are always accompanied by the higher numbers of hours above 90 F. While the 1935 season was mild from the standpoint of outdoor temperatures, it was characterized by unusually high outdoor humidity. This was indicated to a certain extent by Fig. 6 from which it may be observed that the outdoor specific humidity ranged from 92 to 140 grains per pound of dry air in 1935 as compared with a range of from 60 to 118 grains per pound for 1934.

Table 3—Summary of Results of Tests Using Water for Cooling and Using Night Air Cooling for Entire Season of 1935

Weather Data		
1.	Total hours above 85 F for season of 1935	322.6
2.	Total hours above 90 F for season of 1935	82.5
3.	Total degree-hours above 85 F for season of 1935	1,081.8
4.	Total degree-hours above 90 F for season of 1935	174.1
Night Air Cooling		
5.	Total number of nights with night air cooling by fan	63
6.	Total running time for fan during night air cooling, hours.	706
7.	Average rate of power input to fan during night air cooling, watts	443
8.	Total power input to fan during night air cooling, kwhr..	313.1
Air Recirculation without Water Cooling		
9.	Total number of days with recirculation of house air by fan	59
10.	Total running time for fan during recirculation of house air, hours	474.8
11.	Average rate of power input to fan during recirculation without water cooling, watts	415
12.	Total power input to fan during recirculation of house air without cooling, kwhr	196.9
Air Recirculation with Water Cooling		
13.	Total number of tests with water cooling	32
14.	Total running time for fan during test period, hours	201.1
15.	Average rate of power input to fan during test period, watts	433
16.	Total power input to fan during test period, kwhr	87.1
Combined Totals		
17.	Total running time for fan including night air cooling, hours	1,381.8
18.	Total power input to fan including night air cooling, kwhr..	597.1
19.	Total number of hours of test period for season	201.1
20.	Total number of hours of water circulation during test period	120.6
21.	Total quantity of cooling water, gallons	43,300
	cu ft	5,690

From Item 6, Table 3 it may be observed that the total time that the fan was running during periods when it was circulating air from outdoors at night was 706 hours. At the local rate for electrical current of 3.1 cents per kilowatt-hour prevailing in Urbana, Ill., the cost of operating the fan during these periods was 1.37 cents per hour. During the stand-by periods from 7:00 a. m. until the indoor temperature rose to 80 F. the fan was allowed to recirculate the air in the house. As shown by Item 10 the total running time for the fan during these periods was 474.8 hours. During all of the time that cooling was demanded the fan was allowed to run irrespective of whether the water control valve was open or closed. The total time that the fan was running during these periods, as shown by Item 14, was 201.1 hours. The total time during which the fan was operated to recirculate the air in the house was therefore 675.9 hours, and the cost of operating the fan to recirculate the air in the house was 1.31 cents per hour. The total amount of water actually used during the total running time of 120.6 hours was 43,300 gal. At the prevailing rate of 33 cents per thousand gallons this represented an hourly cost of 11.8 cents per hour for water alone, or a total hourly cost of 13.1 cents for both water and electricity during the actual time when the water was running.

PEERLESS *Cleanaire*

Assures positive air circulation and heating perfection throughout the entire house. It filters the air, removing all dust, dirt and fumes leaving the home full of fresh, clean air correctly humidified at all times. Compact, good-looking, easy to install, it operates silently, removes the possibilities of "cold spots" in the house and assists the furnace to operate most efficiently and economically. It has proved its merit mechanically, and the economies it effects soon pay for its small installation cost . . . and of course each installation means a good profit for you.

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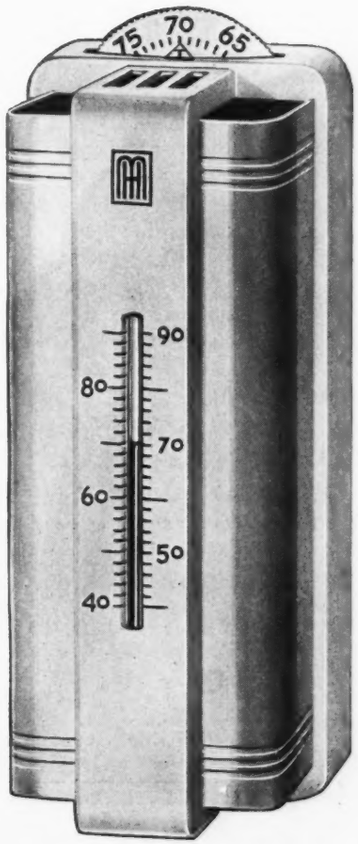
Smartly designed

IT SETS NEW
THERMOSTAT STANDARDS



THE
ACRATHERM
ACTUAL SIZE

STYLED by Henry Dreyfus, one of America's foremost designers, the Acratherm is accepted as the handsomest of modern Thermostats. But regardless of outside beauty, the real test of any Thermostat is performance. The Series 10 Circuit and Heat Acceleration, exclusive Minneapolis-Honeywell achievements, are features found only in the Acratherm and its companion instruments. Thousands of field tests prove that Acratherm performance is as outstanding as its appearance. Minneapolis-Honeywell Regulator Co., 2726 Fourth Avenue So., Minneapolis, Minn. Branch and distributing offices in all principal cities.

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Control Systems

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Owing to wide variations in seasonal demands and in local water and electrical rates, seasonal costs are comparatively meaningless. With restriction of due appreciation of their limitations, however, they are undoubtedly of some interest. During the part of the season over which the plant was in operation, the total cost for electricity for operating the fan both to circulate air from outdoors at night and to recirculate the air in the house during the day was $18.52. The total cost for water was $14.29, and the cost for both electricity and water was $32.81. Although the cooling plant was not ready to operate before July 11, observations on the temperatures and conditions in the Residence were made dating from June 1. The first part of the summer, particularly during May, was unusually cool, and these observations indicated that between May 1, and July 11 only 8 days occurred on which any cooling whatever would have been required. If these days are included, a reasonable estimate of the cost of cooling for the season of 1081.8 degree-hours would be about $36.00.

Conclusions

The following conclusions may be drawn as applying to the Research Residence and the conditions under which the tests were conducted.

(1) Using water from the city mains at 58 F., it is possible to maintain an indoor dry-bulb temperature of 80 F. with the outdoor temperature as high as 100 F. On days when the maximum outdoor temperature exceeds 90 F. the plant will operate continuously over considerable periods of time and it is possible to maintain an indoor relative humidity of 63 per cent, with a resultant effective temperature of 75 F. While not representative of optimum comfort, these conditions do represent a material improvement in atmospheric conditions that would probably be acceptable to the majority of users.

(2) On days when the maximum outdoor temperature does not exceed 90 F. the plant will operate intermittently at all times and the indoor relative humidity will exceed 63 per cent. Under these conditions the maintenance of an indoor dry-bulb temperature of 80 F. will result in effective temperatures exceeding 75 F. and conditions will not be satisfactory from the standpoint of comfort.

(3) On moderately warm days it is possible to operate the plant with 58 F water from the city mains so as to maintain effective temperatures not exceeding 74 F. with indoor relative humidities ranging from 70 to 80 per cent, and to maintain acceptable conditions from the standpoint of comfort.

(4) With 58 F. water from the city mains it is possible to obtain sufficient dehumidification to maintain 63 per cent relative humidity indoors. These results indicate that 60 F. is probably the upper practical limit for the temperature of the available cooling water unless an excessive amount of coil surface is used, in order to maintain indoor dry-bulb temperatures as low as 75 F. in severe weather.

(5) In designing a plant to operate on 58 F. water from the city mains the resistance of the coils to the flow of air and the capacity of the fan available may become limiting factors in determining the amount of surface and character of the coil to be used.

(6) The resistance of the coil to the flow of water is very small, but the pressure loss in the line between the coil and the city main may be large enough to become a limiting factor in determining the amount of water that can be circulated through the coil.

Acknowledgments

The results presented in this paper were obtained in connection with the summer cooling investigation

(*Continued on page 63*)

HESS AIR CONDITIONER FOR HOMES

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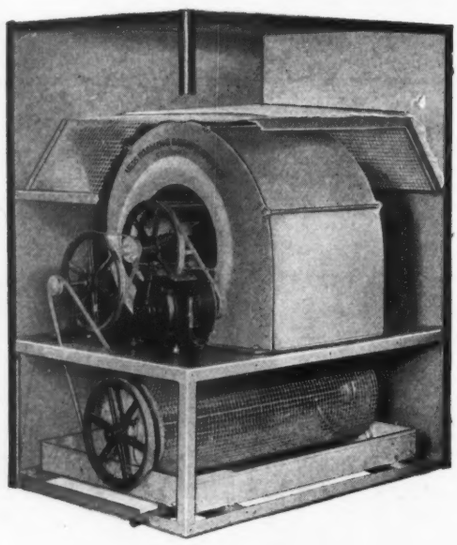

Cutaway View

Substantial cabinet, rounded corners, green and black crinkle enamel finish. Full size hinged access doors, completely factory assembled.

Not just a Blower Filter Unit but also includes a highly successful air washing and humidifying arrangement, very simple and effective.

The conditioner can be used with any furnace for complete winter air conditioning, also for summer benefits. Revolving of the large cylinder, dipping in the large water reservoir, creates a rain action and a water film, through which the air is circulated, automatically giving forty to fifty percent relative humidity in the rooms.

- No spray nozzle, solenoid valve, humidistat, nor pump, not used nor required.
- Water only for humidification, no wasting of water.
- Cellulose fiber filter, inexpensive, throw away when loaded.
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DESCRIBES HESS WELDED STEEL FURNACES
A COMPLETE DEALER LINE

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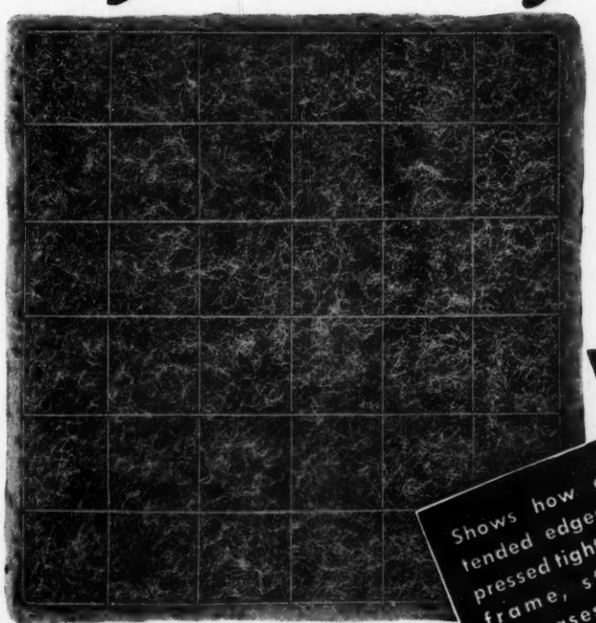
NOW A SELF-CONTAINED *edge-sealing* REPLACEMENT AIR FILTER



- No costly "leaks around edges"
- No extra parts to fit
- No extra adjustments (all ready to put in frame)

Shows how expansion extended edges of filter pad, pressed tightly against holder frame, stops leakage, decreases resistance and increases filtration area 20%.

"It springs to fit"

The natural resiliency of Keratin (chemically treated and sterilized animal hair) which forms the Wilson Edge-Sealing Filter media, causes the edges of the pad to press tightly against the holder frame. This pad is specially formed and kept in position by two spot welded grids which are held securely against each face, by cross connecting wires. This gives proper support and rigidity when handled, but does not affect the natural expansion of the pad to force the edges against the holding frame. This expansion, characteristic of Keratin, not only stops marginal leakage, but prevents impaction throughout the whole filtration area.

If you have a filtration problem investigate Wilson Edge-Sealing Air Filter, and see if it does not justify your investment both on an efficiency and economic basis. Our engineers will be glad to cooperate with you.

This letter speaks for itself

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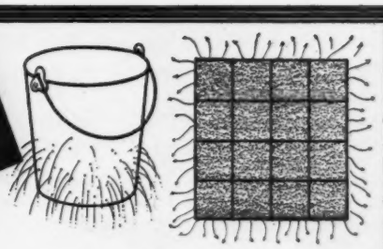
Gentlemen: We have completed the pollen test on your filter today. We used ragweed pollen for making the test. The total number of pollen granules on slides in the air entering the filter was 2,455, the total leaving was 13, which gives an efficiency in pollen removal of 99.47%.

Yours very truly,
E. VERNON HILL CO.
(Signed) E. V. Hill
Aerologists & Engineers



Like water leaks through holes in a bucket, dust-laden air leaks around edges of ordinary filters

DID YOU KNOW

that 10 to 15% of the total air handled by a blower by-passes between the ordinary filter pad and the metal holding frame—thus a blower handling 1600 C. F. M. 15 hours a day, would force over 1,000,000 cubic feet of dirty air around open edges into the conditioned space in one week. This is the marginal leakage which is effectively stopped by the Wilson Edge-Sealing Air Filter.

WILSON *Spider-Web* AIR FILTER EDGE SEAL

TRAPS AND HOLDS DUST

WILSON & CO. HAIR DIVISION — *4100 South Ashland Ave., Chicago*

Per Pound vs. Per Opening

(*Continued from page 33*)

This, of course, varies somewhat, but not materially, depending entirely upon the amount of work to be done on the installation.

Over a year ago in Cleveland we found a great many shops quoting air conditioning jobs on a per opening basis and their quotation ran initially at $18.00 on the warm air side and $15.00 on the cold air side where the cold air returns ran through stud spaces and were merely picked up in the basement and panned across joist spaces and later associated to the blower main.

Cleveland sheet metal men soon learned that they couldn't buy the metal that made up the difference between $15.00 for cold air and $18.00 for warm air for a matter of $3.00 and after this was pointed out to them they attempted to rectify their error by increasing their price to $20.00 per opening for both warm airs and cold airs.

A Fabricating School

At this stage of the game the Central Bureau for Heating and Air Conditioning conducted a school for sheet metal fabricators, in which a complete sheet metal shop was set up and fabrication of actual fittings was done. We took a simple house plan, simple in so far as duct work was concerned, and we priced the job on the basis of openings. We then took off the quantity of metal and figured the job on a basis of actual cost per pound, actual cost for labor in developing the metal, added the labor cost for the erection of the furnace, making and installation dampers in runs, fitting the registers, application of the controls and balancing the job. Pricing the job on the basis of 35c per pound and computing our profit we found that the profit on the poundage basis figured 26% whereas the profit on the basis of a per opening bid showed us 2.7% profit.

The writer asserts that if any sheet metal contractor be in doubt all he need do is to take a job that he has figured on an opening basis and keep an accurate record of the material he used, the labor it took to fabricate plus other items of expense, and add to it a normal profit, whatever that profit may seem in his mind to be, and he will quickly determine the fact that the per opening price, even if it is based on experience, will vary on every job in the percentage of profit the sheet metal shop earns.

The writer further affirms that no business in America (whether it be picking citrus fruit in California, celery in Michigan, digging clams on Oyster Bay, or whether it be our sheet metal business itself), can operate on a fluctuating basis as to the percentage of profit.

In the next article Mr. Farris will take the plans shown here and fill in (step-by-step) the quantity takeoff for material. How the amount of material, at so much per pound and so much labor cost, varies from the price per opening makes an article every reader should be anxious to study.

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THE Superfex air conditioning heating plant of the Perfection Stove Co., Cleveland, reflects the reputation for quality performance of the oil burning equipment developed by this company.
The selection of Throway filters as standard equipment for Superfex is in keeping with Perfection's high quality standards and a strong endorsement of American Air Filter performance.
Bulletin 117C will bring you information on the complete American Air Filter line of furnace filters. Write for it today.
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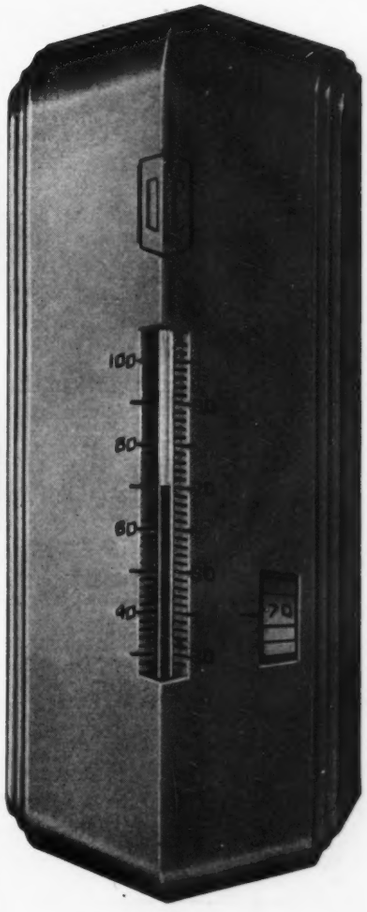
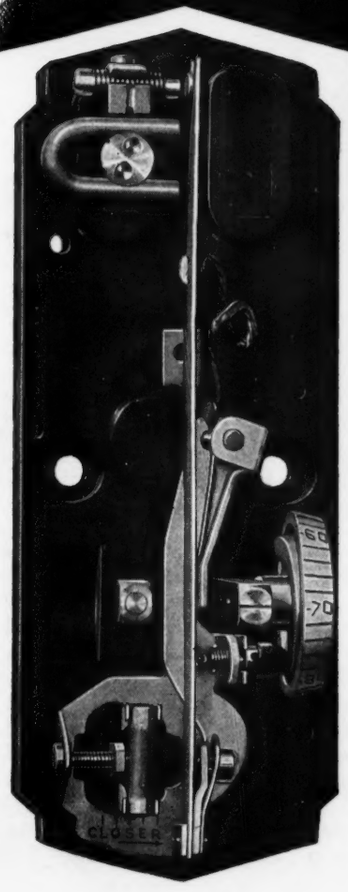
FURNACE FILTERS

WHY the two-eleven HEAT COMPENSATED THERMOSTAT IS DIFFERENT





Compensating type — cover removed to show adjustable heater element

THE Two-Eleven Thermostat with adjustable heat compensation operates differently from the conventional heat anticipating thermostat.

The heater element draws its current by a separate circuit—not through the "load." Thus one thermostat can be used for any load, without changing parts or replacing the instrument. The trade can stock *one thermostat* for use with *all* "Genuine Detroit" Controls or others on a circuit of 20-25 volts.

The heater element is easily adjustable after installation to meet the requirements of each job, regardless of exposure, type of construction or kind of heating plant.

The heater is scientifically designed and located so that, after adjustment on the job, extreme cold weather has practically no effect on the operating point.

Field adjustment of the Two-Eleven is not a critical operation. For the average installation this thermostat will give satisfactory regulation just as it is received from the factory.

The adjustable heater makes it unnecessary to change the "air gap" adjustment at the contacts. This is set at the factory to assure best response to heater effect.

The exterior is beautifully styled and finished to harmonize with modern interiors—designed to blend into its surroundings yet dignified and attractive in itself.

The Two-Eleven is also supplied without the heat compensating feature if desired. Both types in all models for heating, cooling, night and day, summer and winter and three wire.

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Damping Oil Burner Noise

By S. S. Swift

NOISE is one of the bugbears of the service man in the installation of oil burners in warm air furnaces. The causes of objectionable noises are almost too numerous to cover in any reasonable article, but here are some of the common causes:

Rigid pipe connections which formerly caused so much trouble have of course given way largely now to copper tubing, and this has bettered one condition we have all had much trouble with.

At first I think we were all inclined to use too small tubing, but with experience we have learned that ½-inch suction lines are more likely to be quiet and cause less trouble than ⅜-inch lines.

The question of the necessity of a return line to the tank on small jobs has caused considerable controversy, but it has been almost conclusively determined now that a return line on small jobs is not necessary. It fact, on many small installations the burner will operate much quieter without a return line.

The possibility of gasifying some of the oil in the suction line where too much of a vacuum is pulled should always be considered by the installation man. If the pump is pulling in 20 or more gallons per hour of oil from the tank instead of the 1½, 2 or 3 gallons delivered at the nozzle, it may very easily account for pump noises, especially if the flow is restricted by line strainers, too small pipe sizes or too much of a lift. Any time a vacuum gauge shows over 6 inches of vacuum, the smart service man will expect pump noises. If he experiences them he will first do things to reduce the vacuum instead of changing the pump or other mechanical parts of the burner.

The inches of vacuum that can be pulled on any oil suction line, of course, is determined by the character of the oil and its temperature. Warm or hot oil will vaporize more easily than cold oil, and less vacuum can be pulled on the suction line without trouble.

Another common cause of noise is due to the vibration set up in the jacket of the furnace. To avoid the possibility of this it will pay to wrap the end of the air tube of the burner in 2 or 3 inches of mineral wool before it is cemented in.

Sometimes without knowing it, fire brick or asbestos cement will make a rigid connection between the air tube and the ash-pit door-frame casting. This may set up a vibration that is conducted up the warm or cold air pipes to the registers in the living rooms of the house.

Flame or combustion noises can be greatly reduced by making the walls of the combustion chamber rough and uneven instead of smooth. Combustion noises can also be very much modified by adjustment of the burner, and this is preferable, as rough combustion walls do not have a workmanlike appearance.

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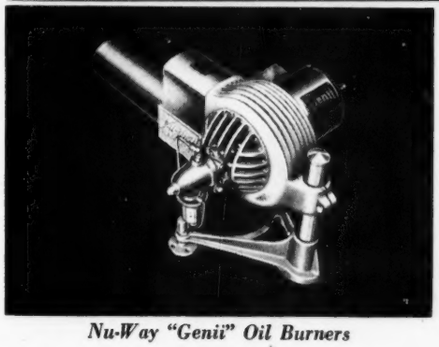

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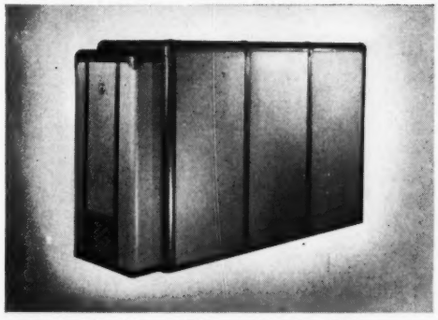

Nu-Way Evans Warm Air Conditioner

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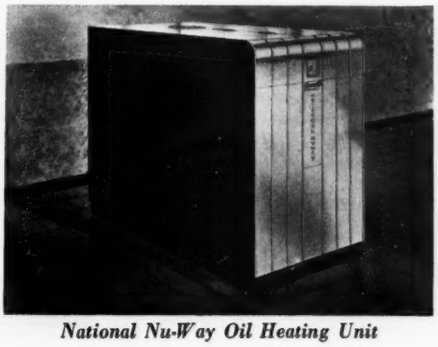

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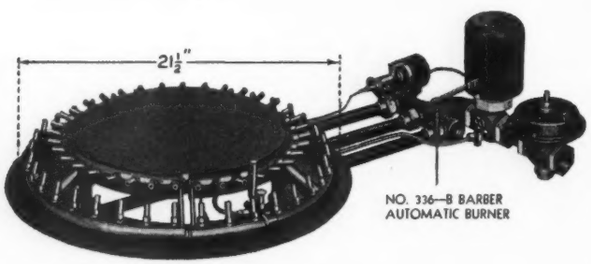

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Konzo Forced Air Facts

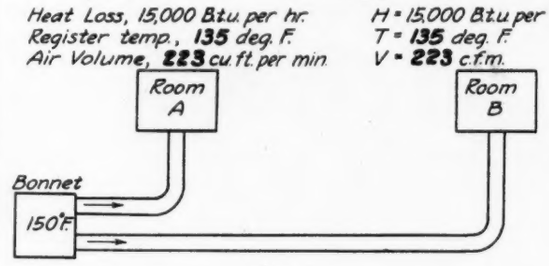
(*Continued from page 37*)

were of considerable magnitude. Fig. 2 from Bulletin 266 shows a typical diagram of temperatures at various points in the system for both on- and off-periods for the fan. The values in parentheses for the off-period of the fan may be disregarded in the present discussion, while the values for the on-period are studied in more detail. For the purpose of analysis the significant temperatures in Fig. 2 have been tabulated in Table 2.

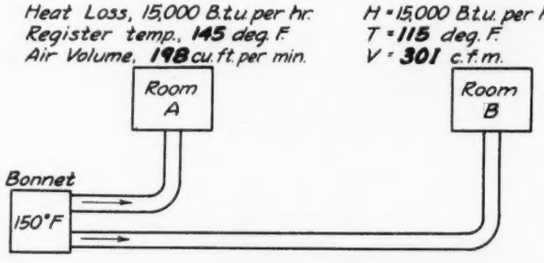
TABLE 2
Temperatures in Duct System in Forced-Air Heating System
Typical set of observations for an outdoor air temperature of 45 deg. F.
(*Temperature values are only for the on-periods of the fan.*)

Description	Temperature
Bonnet, average	119.2
First Story Registers	
Sun room, average of two	101.7
Dining room	110.0
Hall	113.0
Living room	110.0
Kitchen	107.0
Second Story Registers	
East Bedroom	112.0
Southwest Bedroom	101.0
Bathroom	94.0
Northwest Bedroom	108.0
Third Story Registers	
East Dormitory	114.0
West Dormitory	95.0

It may be noted that even with the fairly low temperatures in the duct system the variations in the register air temperatures were exceedingly large. During



CASE I.
Design condition.
Register air temperature assumed to be 135 deg. for both rooms. Return air = 65°F.



CASE II.
Actual condition, assumed.
Register air temperatures are not the same for both rooms, due to loss of heat from ducts.

Examples Illustrating Importance of Making Proper Estimate of Register Air Temperatures.

Fig. 3—Case 1 shows what we may assume happens in two rooms of identical size and heat requirement, but case 2 shows what we actually get and why we should compensate for air temperature drop through the ducts.

colder weather when the temperatures in the duct system were of larger magnitude, these variations in the register air temperature were even greater.

d. Effect of Unequal Register Air Temperatures.

The importance of making proper estimates of the register air temperature in the design of a forced-air heating system can best be illustrated by means of examples such as are shown in Fig. 3. In Case 1 is shown the usual method of calculations. Rooms A and B are each assumed to have a heat loss of 15,000 B.t.u. per hour, and the bonnet air temperature is assumed to have a value of 150 deg. F. In addition, the register air temperatures are assumed to be 135 deg. F. and the return air temperatures are assumed to be 65 deg. F. The calculated air volume required at each supply register is 223 cu. ft. per minute for each register.

In the actual installation the temperature conditions may be as indicated in Case II. That is, the duct to Room A may be short in length and may be accompanied by a small heat loss resulting in a register air temperature of 145 deg. F. instead of the 135 deg. F. that was assumed in the design condition. The air volume requirement at the supply register is 198 c.f.m. instead of the 223 c.f.m. obtained in the design process. In this case where the actual air requirements are less than the calculated requirements no difficulty is experienced in balancing the plant, since the dampers in the duct can be adjusted to restrict the air quantity to the proper amount.

However, the conditions illustrated in Room B in Case II are not as easily remedied. In this case, where the duct is long and the heat loss from the duct is large, the register air temperature may likely be 115 deg. F. instead of the 135 deg. F. assumed in the design of the system. The actual air volume requirement at the supply register is 301 c.f.m. instead of 223 c.f.m. In other words, 35 per cent more air is required through the ducts and registers to Room B than was calculated to be the case.

Compensation Costs Money

A large discrepancy of this nature cannot be remedied, without considerable adjustment in the balancing of the duct system. The usual procedure in a condition of this sort is to damper down all the shorter ducts in the system in an attempt to force more air through Duct B. In addition it may be necessary to increase the fan speed in order to meet the new requirements. In any case, the pressure losses are larger than would be the case if proper estimates of the air volumes had been made before the ducts were installed. The net result is that the owner of the installation is required to pay for higher operating costs for the fan. In some cases the readjustments in balancing the plant may be accompanied by air noises in the undersized duct, fan noises due to excessive speed, and shortened life of the fan motor and fan.

Therefore, the problem of making a proper estimate of the register air temperature is not an academic one, but is one that is of practical importance. The writer recommends that the matter of heat loss from ducts and the estimate of individual register air temperatures be given careful consideration in all forced-air heating

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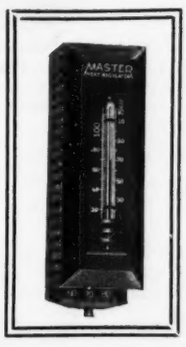

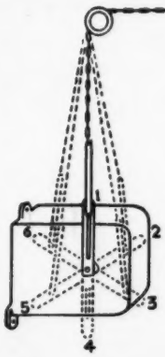

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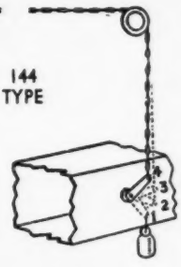

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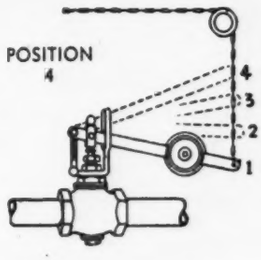

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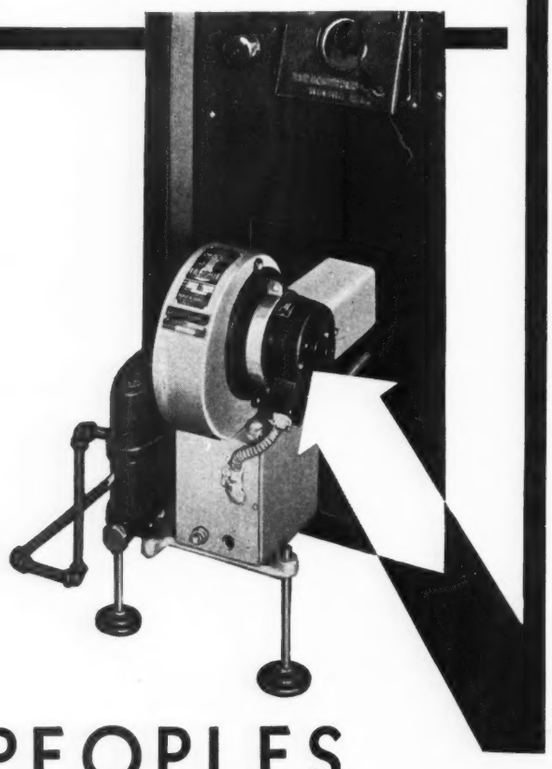

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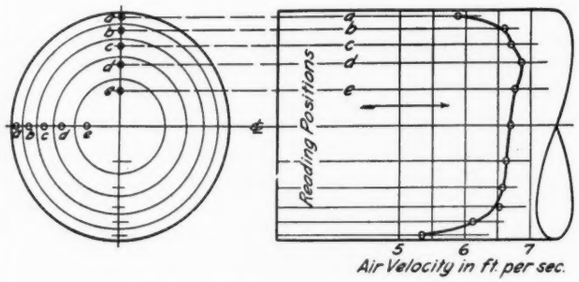
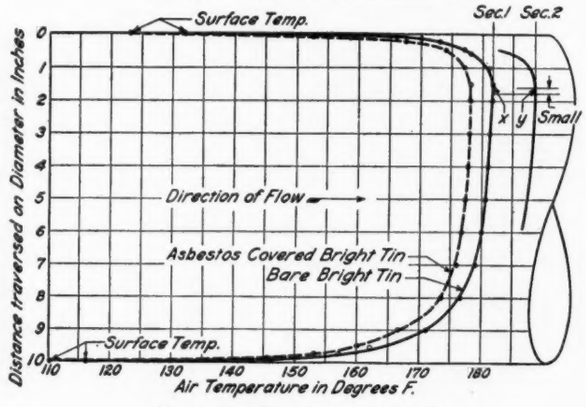
systems, and particularly in those systems which have ducts of unequal lengths, or which have ducts passing through cool spaces.

Incidentally, it is of interest to note that a similar problem confronts the designer of a gravity, hot-water radiator heating plant. Since the heat emission from hot water radiators is in proportion to the temperature of the hot water circulating through the radiators, a low water temperature in the radiator will require more radiating surface to supply the heating requirements of a given room than will a high temperature of the water in the radiator. Therefore, the assumption that the



VARIATION IN VELOCITY ACROSS A 10-INCH LEADER



TEMPERATURE TRAVERSE OF A 10-INCH LEADER

Fig. 4—Typical diagram of velocities and temperatures in a duct carrying heated air. (One of the difficulties of calculating the heat loss from ducts is that the wall surface temperature is not the same as the average temperature of the moving air stream. This can be determined only from laboratory experiments on ducts carrying heated air.

water in all the radiators of a given structure will be at the same temperature may create difficulties of the same nature as those described for the forced-air heating system.

e. Use of an Average Value for Temperature Drops.

If all the factors affecting the heat loss from ducts could be predetermined the calculation of the heat loss could be made for any given condition. However, it is apparent that a great many factors affect this heat loss, and that some of them cannot be numerically evaluated. (See Fig. 4.) For example, it may be shown that some or all of the following items affect to some extent the heat loss from ducts carrying heated air:

a. Nature of surface of duct
b. Conductivity of wall of duct
c. Temperature of air in duct
d. Temperature stratification of air in duct
e. Surface temperature of duct
f. Velocity of air in duct
g. Temperature of air surrounding duct

h. Velocity of air surrounding duct
i. Temperature of surfaces receiving radiation from duct
j. Shape and size of duct
k. Axis of duct, whether horizontal or vertical
l. Environment of duct, whether enclosed in joist or in open space
m. Straightness of duct or freedom from bends and turns
n. Viscosity and density of heated air
o. Area of exposed duct

For idealized conditions the values of heat loss may be calculated, but the presence of so many unaccountable factors makes such calculations extremely limited in application. In the succeeding article the author will present two equations, derived by Heilman, which can be used for such special cases and for checking values obtained by other means.

In view of these conditions, and since experimental values of heat losses from ducts carrying heated air are extremely meager in quantity, the writer is of the opinion that for ordinary practical work some generalized value of "temperature loss per foot of duct" may prove more suitable for use.

However, it should be recognized that "temperature loss per foot of duct" is not an exact criterion of the heat loss from ducts. For example, a large quantity of air through one duct may lose the same amount of heat as a small quantity of air through the same duct and yet the "temperature drop" for the first case may be much smaller than that for the latter case.

With due recognition of these limitations, some "average value" obtained from an "average installation" should prove of interest. The temperature values, such as those shown in Fig. 2 and Table 2 from the Research Residence data indicate that for an initial temperature of 135 deg. F., in a duct whose length is approximately 30 feet, the temperature drop per foot of duct is of the order of 0.4 to 0.6 deg. F. *Therefore, for ordinary practical work a value of 0.5 deg. F. per foot of duct* is suggested as a reasonable value to use. The subject of temperature loss from ducts will be continued in the next issue of this magazine to indicate the practical application of this figure.

Cooling With City Water

(*Continued from page* 54)

(1935) in the Research Residence[8], Fig. 1, at the University of Illinois, conducted by the Engineering Experiment Station of which M. L. Enger, Dean of the College of Engineering is the director, in the Department of Mechanical Engineering of which O. A. Leutwiler, Professor of Mechanical Engineering Design, is the head. These results will ultimately comprise part of a bulletin of the Engineering Experiment Station. Acknowledgment is also due to J. S. Cunningham, Research Assistant, for services rendered in connection with the investigation, and to the various manufacturers who cooperated by furnishing instruments and equipment.

[8]The Research Residence in Urbana, Ill., was built, furnished, and completely equipped specifically for research work in warm air heating by the *National Warm Air Heating and Air Conditioning Association* in December, 1924.

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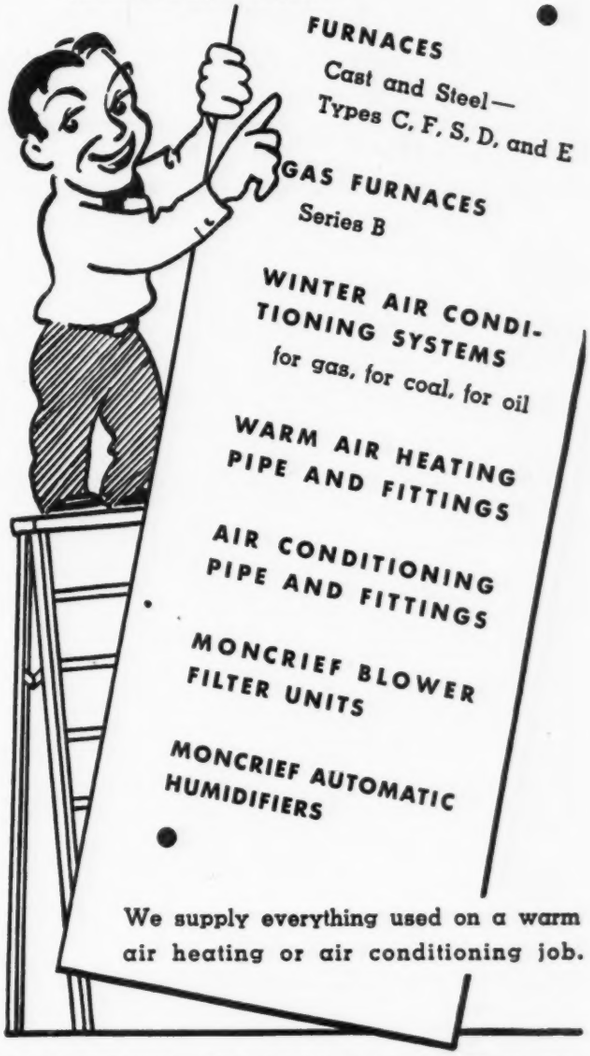

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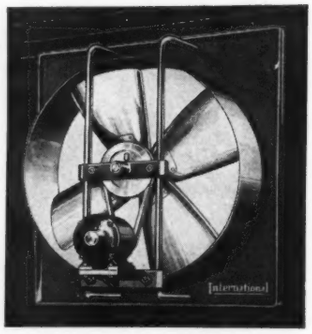

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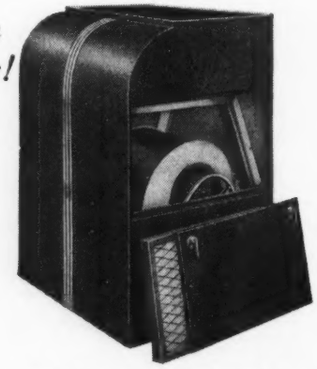

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Calculating Cooling Load

(*Continued from page* 40)

duction of heat through the walls of the ducts in a central plant system, particularly where the ducts run through unventilated attics, outside walls, etc. The amount of heat thus conducted to the conditioned air can be calculated from a knowledge of the temperatures inside and outside the duct, and from a consideration of the usual heat transfer phenomena. In general, the following formula may be used with sufficient accuracy.

$$H_d = A_d \, U_d \, (t_1 - t_2) \qquad (12)$$

$$U_d = \frac{1}{\frac{1}{1.2} + \frac{t}{k}} \qquad (13)$$

where

H_d = heat transmitted through walls of duct system, Btu. per hour.
A_d = area of duct surface, sq. ft.
t_1 = temperature of air outside the duct, F.
t_2 = temperature of air inside the duct, F.
t = thickness of insulation applied to duct, inches.
k = conductivity of duct insulation, Btu. per hour per sq. ft. per F. per inch thickness.

Another unusual source of heat gain arises when rooms or furred spaces are used as plenum or return air chambers. Sometimes the walls of such chambers adjoin very hot spaces, like kitchens or attics, and sometimes they are exposed to the outside. When such cases are encountered, it is necessary to calculate the heat gain of the air chamber as well as the heat gain of the air conditioned space.

A third source of unusual heat gain arises when steam pipes are hidden in the walls and carry steam during the summer time. This might happen in hospitals or various industrial plants, for example. Such cases as this are rare but have been known to result in the maintaining of unsatisfactory indoor conditions when their existence was not known before the equipment was installed. Calculation of heat gain from such sources may be made on the basis of the temperatures involved and the usual heat transfer phenomena.

Methods for Reducing Heat Gain

The application engineer should always be on the alert for opportunities to reduce the heat gain of a structure where means are available to do so in such a manner as to reduce the net cost of the installation over the period of its life.

The use of insulating materials in walls which have a heavy heat gain is one obvious method of reducing the size of equipment required. The use of awnings, blinds or shades is an aid in the reduction of sun effect through windows. Of course, such shades, blinds, etc. are of no benefit unless they are drawn. The spraying of water on roofs which are directly over the air conditioned spaces is another method which has been tried successfully at times. This water may sometimes be taken from the water discharge circuits of the condensing unit or from an independent circuit. Attic ventilation is another means of effectively reducing the heat gain through the roof. In many cases, unventilated attics situated beneath roofs which are exposed to the

full intensity of the sun may rise to temperatures as high as 130 or 140 F. Since the outdoor air is seldom hotter than 110 deg., it has the capacity to remove heat from such attics, provided it is forced through by a suitable fan or blower. The fan should be able to provide in the neighborhood of 30 complete air changes per hour in the attic space. Under such conditions the average air temperature in the attic space would usually be from 5 to 10 deg. warmer than outdoors during the middle of the afternoon, when the sun effect is greatest. There are times, of course, when attic insulation may be more valuable than attic ventilation.

Summary and Conclusions

This paper has described a complete and systematic method for determining the character and magnitude of the cooling load for air conditioning systems. The salient features of this method may be summarized as:

1. It organizes and systematizes the work so that a complete and accurate calculation requires a minimum of both time and technical experience.
2. A new and simple method is presented for accurately calculating the sun effect through opaque walls and roofs.
3. The method of separating the components of the total load is such that the total sensible and total latent heat gains may be determined for any hour of the day.
4. An approximate method of allowing for time lag effects resulting from heat storage further improves the accuracy of the calculations.
5. A procedure is given for predetermining the time of day when the total heat gain is greatest.
6. The general procedure is applicable to an hour-by-hour calculation of the cooling load, if the economics of the application warrants it.
7. Although the discussion has been centered around the determination of the maximum total heat gain, it is equally adaptable to the determination for various conditions of operation, and may be used to determine the maximum ratio of dehumidification to sensible cooling.

The method of making heat gain calculations described herein has been under development for several years, during which time it has undergone many refinements of detail. However, it has been used in fundamentally the same form as presented here for over 2 years by a large number of application and sales engineers. The experience gained from the many installations made on the basis of cooling loads calculated in this manner has substantiated its simplicity and reliability.

The method is not perfect. There is a large field for improvements. Some of the points which need elaboration and refinement are:

1. The effects of heat storage in walls on the cooling load when a constant indoor temperature is maintained.
2. The effects of heat storage on the pull-down load after the cooling system has been shut down for some time, or following a sharp change in outdoor temperature.
3. More complete data on infiltration rates during the cooling season.
4. More complete data on the load reducing properties of various types of shading devices, expressed as a function of the type of material and age.
5. More complete and accurate data on the ability of various outside building surfaces to absorb solar radiation, expressed in terms of the type and age of the surface, and the angle of the surface with respect to the rays of the sun.
6. A more complete analysis of climatic data.

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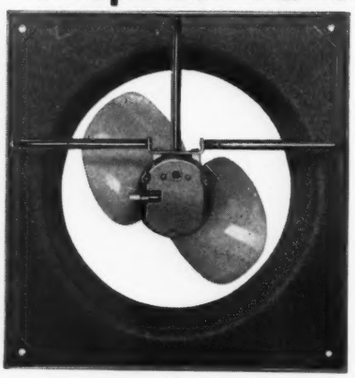

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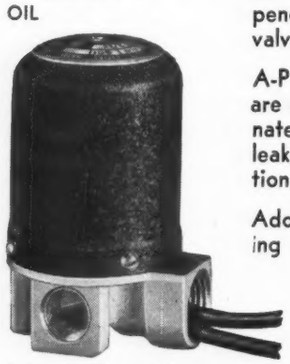

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Kratz Comfort Factors

(Continued from page 44)

all heating plants, the extent of the deviation is influenced by the type of the heating units or heating system. All indications point toward the fact that it would be better practice to locate the thermometer at the 30-in. level rather than at the 5-ft. level.

The same principles apply even more forcibly to the location of the control thermostat than to the location of the thermometer. If the thermostat is placed at the 5-ft. level, and conditions are not complicated by other factors, a comfortable temperature may be maintained at the 5-ft. level, but a lower temperature in the living zone will exist resulting from the normal temperature

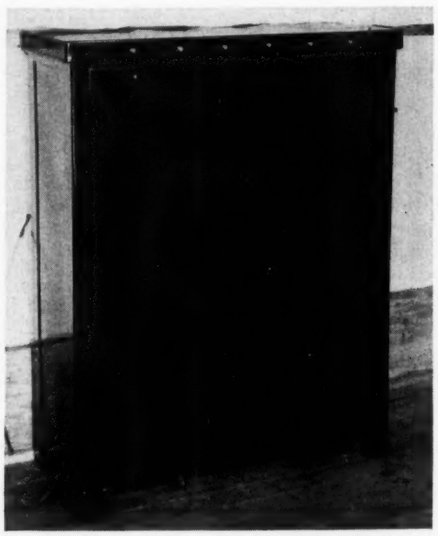

Fig. 9—Enclosure No. 10 tested in cold room testing plant.

gradient in the room. Unfortunately this situation is further complicated by other factors.

The thermostat can not act to open the dampers, or start the burner, until the air at the 5-ft. level has cooled to the temperature predetermined by the setting of the thermostat. Meanwhile the dampers remain closed, or the burner remains off, and practically no heat enters the room. At the same time cold outdoor air enters through cracks in the window and door frames, and the

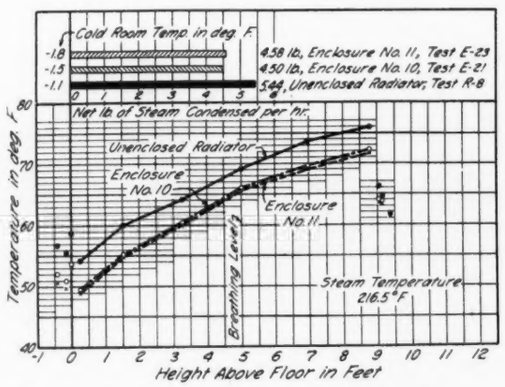

Fig. 10—Room temperature gradients and steam condensing rates for radiator with enclosures Nos. 10 and 11. (From Univ. of Ill., Eng. Exp. Sta., Bulletin No. 192, Fig. 27.)

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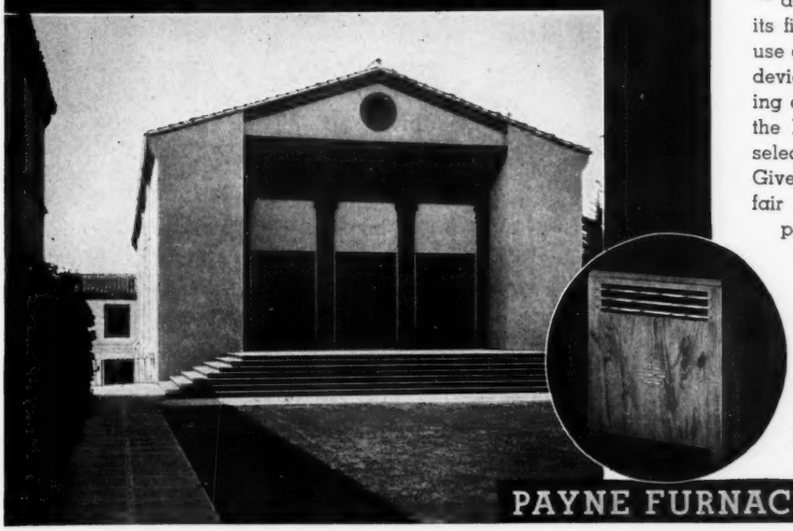

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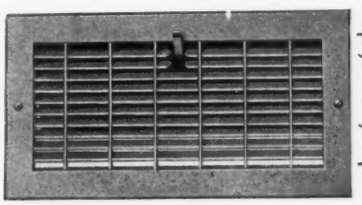

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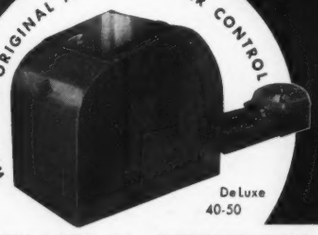
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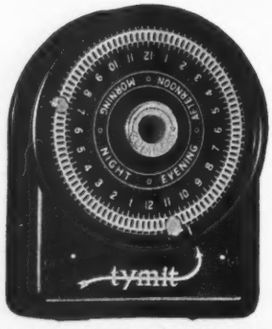

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air in contact with the cold glass becomes chilled. All of this cold air collects as a pool near the floor, and if the off-periods extend over a considerable time, the temperature gradient becomes much more pronounced than it is during the periods when the heater is in actual operation. Hence, during the off-periods the room may become decidedly cold before the thermostat acts to furnish more heat.

This condition, sometimes known as the "cold 70," is more prevalent with gas and oil fired systems than with coal fired; because in the latter case the heat stored in the fuel bed continues to be supplied to the room even when the dampers are closed, but in the former case the heat supply ceases soon after the burner becomes inoperative. In the case of forced-air heating systems this condition can often be improved by placing the thermostat at the 30-in. level and adjusting it to decrease the length of the off-periods. In the case of gravity warm air systems and steam and hot water systems, it is not so certain that this procedure will entirely correct the difficulty.

Humidification

Medical opinion concerning the physiological effects of atmospheres of low relative humidity is not entirely unanimous, and some authorities claim that for normal individuals any direct relation between relative humidity and health has not been definitely proved. Hence it appears that comfort affords the best argument in favor

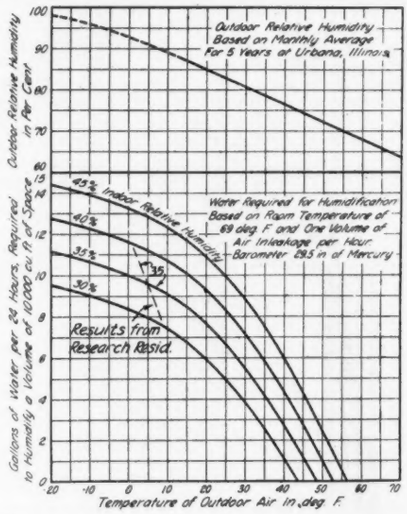
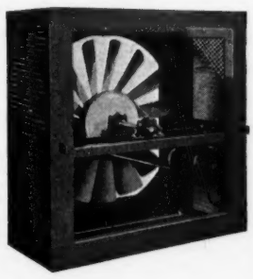

Outdoor Relative Humidity Based on Monthly Average For 5 Years at Urbana, Illinois
Outdoor Relative Humidity in Per Cent
45%
40%
35%
30%
Indoor Relative Humidity
Water Required for Humidification Based on Room Temperature of 69 deg. F and One Volume of Air Infiltration per Hour. Barometer 29.5 in of Mercury
35
Results from Research Resid.
Gallons of Water per 24 Hours Required to Humidify a Volume of 10,000 cu. ft. of Space
Temperature of Outdoor Air in deg. F.

Fig. 11—Curves for evaporative requirements for humidifiers. (From Univ. of Ill., Eng. Exp. Sta. Bulletin No. 230, Fig. 2.)

of adequate humidification. At any rate, comfort seems to offer the most tangible standards of measurement. The comfort chart previously mentioned indicates that maximum comfort will be attained with a temperature of 70 deg. F. and relative humidity of 50 per cent. If the relative humidity is decreased to 20 per cent the same degree of comfort will be maintained if the air temperature is increased to 73 deg. F. Relative humidity below 20 per cent will produce a sensation of dryness, but there seems to be evidence to support the belief that it may be as low as 20 per cent without undue effect on comfort, although it is customary to recommend 40 per cent as being the most desirable value.



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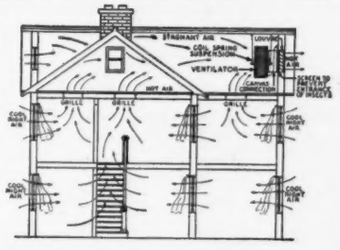

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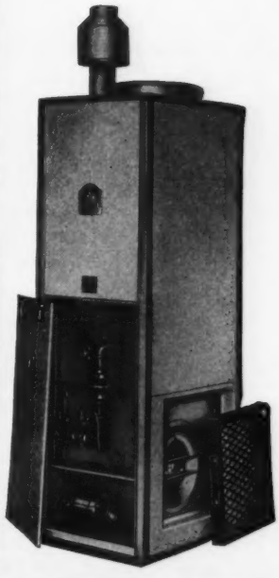

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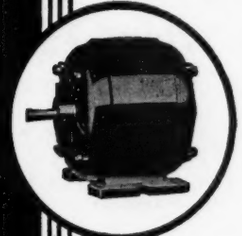

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No saving in fuel resulting from increasing the relative humidity can be demonstrated. While it is true that an increase in relative humidity permits the use of somewhat lower air temperature to maintain the same degree of comfort, thus representing a potential saving in fuel, the additional heat required to evaporate the water almost exactly offsets the saving effected by the decrease in air temperature. Hence, the importance of humidification has been to a certain extent overrated.

Since the recommendation of 40 per cent relative humidity is usually regarded as conservative, the implications involved in the maintenance of this amount may well be examined. The amount of infiltration of outdoor air into the average well built house without weatherstripped windows amounts to approximately one air change per hour. Fig. 11 shows the weight of water required to be evaporated in order to maintain various percentages of relative humidity in 10,000 cu. ft. of space for different outdoor temperatures.

From these curves it may be observed that it requires 11.5 gal. of water per 24 hours, in order to maintain 40 per cent relative humidity in 10,000 cu. ft. of space when the outdoor temperature is zero. A medium sized residence will contain approximately 15,000 cu. ft. of heated space, and would therefore require evaporation of the order of 17 gal. per 24 hours. If weatherstripped windows or tightly fitting storm sash are used the air infiltration may be materially reduced and the evaporation requirements may be correspondingly reduced to 8 gal. per 24 hours or less.

The usual warm-air furnace pan will evaporate about 2 gal. per 24 hours, and under the best conditions will not evaporate more than 5 gal. per 24 hours. A pan placed on the dome of the furnace will, under the most favorable conditions, evaporate as much as 14 gallons per 24 hours. Open pans used in connection with steam

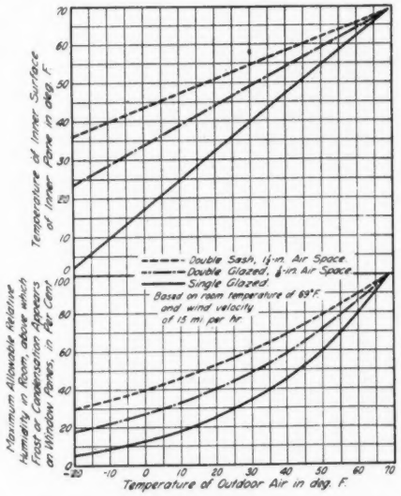
Temperature of Inner Surface of Inner Pane in deg. F.
Maximum Allowable Relative Humidity in Room, above which Frost or Condensation Appears on Window Panes, in Per Cent
Double Sash, 1½-in. Air Space
Double Glazed, ¼-in. Air Space
Single Glazed
Based on room temperature of 69°F. and wind velocity of 15 mi. per hr.
Temperature of Outdoor Air in deg. F.

Fig. 12—Curves for glass surface temperatures and limiting values for relative humidity. (From Univ. of Ill., Eng. Exp. Sta. Bulletin No. 230, Fig. 3)

radiators will evaporate approximately 0.75 gal. per sq. ft. of water surface per 24 hours. The evaporation of 17 gal. per 24 hours would therefore require 23 sq. ft. of surface, or since the average pan is about 10 in. wide, it would require the equivalent of a pan 27 ft. long. Hence, it is evident that 40 per cent relative hu-

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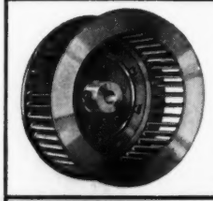

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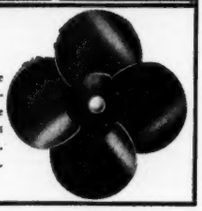

midity cannot be maintained in zero weather without some special effort in the design of the heating system or the use of auxiliary apparatus.

If water vapor is present in the air, condensation will occur on any surfaces that have a temperature less than the dew point. Fig. 12 shows the percentage of relative humidity at which condensation will appear on three types of windows for different outdoor temperatures. From these curves, if 40 per cent relative humidity is maintained indoors condensation will start to appear on windows composed of a single thickness of glass when the outdoor temperature drops to 35 deg. F.

If tightly fitting storm sash are used the outdoor temperature can drop to zero before condensation starts. Stated differently, with zero weather outdoors, indoor relative humidity of 40 per cent can be maintained without material condensation if storm sash are used, but not to exceed 15 per cent if storm sash are not used.

Where single thickness windows are used without weather-stripping a protective layer of cold air enters through the cracks around the sash that tends to dilute the more humid indoor air at the surface of contact. Hence, it is sometimes observed that less condensation occurs on windows that are not weatherstripped than on corresponding windows that are weatherstripped.

Wall Condensation

Poorly insulated walls may have surface temperatures sufficiently low to result in condensation when relative humidity as high as 40 per cent is maintained. Even with fairly well insulated walls, if the temperature in the house is allowed to drop materially at night, the temperature of the inside surfaces may decrease to a point that if the furnace is forced the next day enough evaporation may take place in a short period to raise the relative humidity high enough for condensation to occur on the exposed walls. In the case of frame walls, it is practically impossible to have the window frames, baseboards, etc., so tight that no air leakage occurs from the room into the studding spaces. Condensation may then take place on the inside surface of the sheathing, and water may ultimately soak through to the clapboards or stucco.

Since considerable difficulty may be experienced with high relative humidity, it hardly seems practical to recommend 40 per cent for all residence irrespective of their particular features of construction. The lowest boundary of the comfort chart, 30 per cent, is safely within the limits of comfort, and there is reason to believe that within the proper temperature limits 20 per cent is not noticeably too dry for comfort. Hence, for residences with average construction and not equipped with storm sash, 25 per cent relative humidity in zero weather would seem to be a reasonable value to provide comfort and to avoid some of the difficulties liable to result from attempts to maintain unduly high humidity.

Importance of Good Construction

While the theory that the attainment of comfort consists of creating an environment in which the heat loss from the body can offset the heat generated, without the necessity for conscious bodily adjustments, is simple in its conception, it is also evident that a considerable number of factors influence the attainment of this end.

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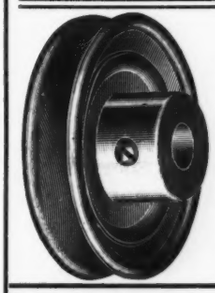
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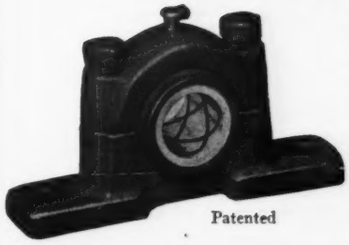
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Randall standard pillow blocks are solving completely the bearing problems of most manufacturers in the air conditioning field. Self-lubricating, self-aligning, trouble-free, quiet! Write for literature, sizes and prices.
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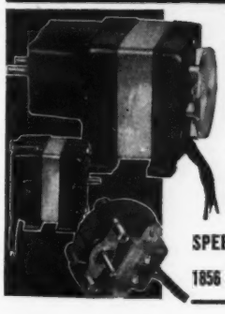
For Damper Motors, Controls, Fans—a Type for Every Need
DEPENDABLE 110-volt miniature Induction and Universal Motors (AC or DC), both encased and skeleton types, with or without built-in gear box that gives range of speeds and one or two drive shafts. Built to industrial standards. Thousands in use doing hundreds of different jobs. Remarkably low prices—on one or a million. Also low voltage motors.
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SHEER COMFORT
heat Regulator

Strong, sturdy, three wire type. Sensitive Thermostat of unusually attractive appearance. Has silver contacts. Induction type Damper motor; bronze-bearing construction; heavy gear shafts, extra heavy die cast gears. Has unusual power. All pulleys, wiring, staples furnished. No extras. Full liberal guarantee. Approved by Anthracite Institute.

DEALER'S PRICE
$13.34 each
Lots of Ten

DEALERS! WRITE TODAY for unique selling plan on this low-priced Heat Regulator. Sales helps such as stuffers, display boards, demonstration kits can be furnished. Also complete line of Limit Controls, Humidifiers, Thermostats and Temperature Control Equipment. Write Dept. AA-1

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CHAMBERLIN

AUTOMATIC HUMIDIFIER

DEPENDABLE—PROFITABLE

FITS ANY FURNACE—
ONE PIECE CASTING

VALVE FREE FROM LIMING

Here's a fully automatic trouble-free humidifier cast entirely in one piece. Valve completely out of water. Trap cast integral reduces liming. Quickly installed. Manufactured over 10 years. Write for literature and prices.

CHANDLER COMPANY
CEDAR RAPIDS, IOWA

By Preference
it's DeWITT OPERATED HOTELS · Genuinely Friendly

In Cleveland it's
☐ *The* HOLLENDEN

In Columbus it's
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In Dayton it's
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In Akron it's
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In Toledo it's
☐ *The* NEW SECOR

In Savannah (Ga.) it's
☐ *The* GEN'L OGLETHORPE

In Miami Beach it's
☐ *The* FLEETWOOD

DeWitt Operated Hotels
feature
Unusually Comfortable Rooms at Reasonable Rates and the finest of Food and Beverages. Carefully Prepared and Served.

Some of these factors are inherent in the design and operation of the heating or cooling plant. Most of them, however, are influenced directly by the character of the structure in which the plant is installed. Thus features of good construction like air-tight walls, heat insulation, weather stripped windows and storm sash all have significant bearing on comfort and the ability to maintain proper humidification, as well as on the economical operation of the heating plant.

Considerable effort has been directed toward the design of the heating or cooling plant, and until recently, not enough attention has been paid to the structures housing this plant. In a properly constructed building the problem of the heating or cooling plant is comparatively simple and it should be the function of the air conditioning engineer to arouse the public interest in good construction and to insist on such good construction as being inseparable from the proper functioning of the heating or cooling plant itself.

Air Leakage Past Filters

(*Continued from page* 46)

"Our investigations disclose that leakages up to 20 per cent are frequent. This means that with a 1,000 cfm. blower, operating ten hours per day and by-passing 20 per cent of the air around the filter, 3,600,000 cu. ft. of dirty air will be delivered to the house in a month's period if the blower operates ten hours per day. If this leakage is reduced to about 10 per cent, 1,800,000 cu. ft. of dirty air will be by-passed, and with a reduction in leakage to about 1 per cent, (which is possible), only 180,000 cu. ft. of dirty air will be by-passed per month."

Wilson & Company, in their bulletin entitled "Information on the Use of Air-Filter Pads in the Warm Air Heating and Air Conditioning Field" declare that their investigation indicates an average leakage of 10 to 15 per cent of unfiltered air by-passed around filters. Wilson & Co. points out that as the filters load up and resistance through the filter increases, more and more air tends to by-pass, which aggravates the condition.

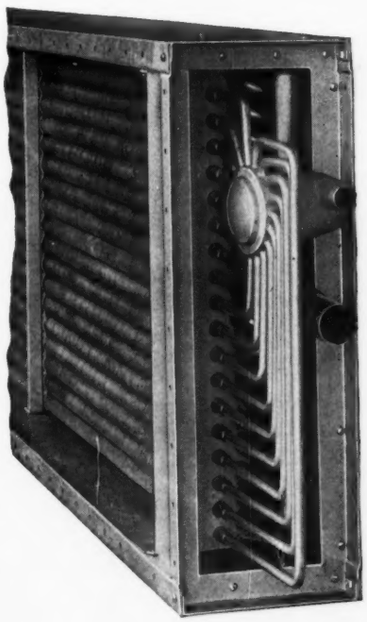
Both companies have prepared a series of sketches showing recommended methods of using gaskets and installing filters in all types and sizes of blower housings in order to insure absolute sealing and elimination of all by-passed air. These drawings, which the companies have prepared, indicate that the recommendations are exceedingly simple and that no alterations are required in the average blower housing which contains suitable frame work to hold the filter cells. The problem comes in sealing the edges of adjoining filter cells and in sealing the space between the edge of the filter and the blower housing. Where the filter frame is welded or riveted to the housing and is airtight, the problem becomes one of sealing the point of contact between the frame work and the filter unit.

The illustrations with this article show typical suggestions by the two companies.

Announcing

AEROFIN

Direct Expansion Cooling Coils with Exclusive Centrifugal DISTRIBUTING HEADER



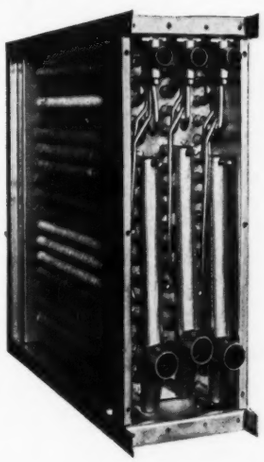
Aerofin Direct Expansion with new Centrifugal Distributing Header, designed to meet changing conditions in air conditioning practice.

Below: Aerofin Direct Expansion with standard distributing and suction headers allowing control for each row.

THE new Aerofin Centrifugal Distributing Header for direct expansion cooling coils is the result of extended research and extensive field tests.

It provides a proven method for automatically distributing the refrigerant evenly through all circuits of the evaporator where only one connection for each coil is required. It saves costs on installation, is simple and fool-proof.

This distributing header, like all standard Aerofin equipment, minimizes pressure loss. Made in 2 to 6 rows of tubes in standard 10" depth casings.



New Supplement to Bulletin D. E. 34, gives complete tables and curves for selecting proper size and type. Permits accurate determination of final air condition leaving coil. Send for your copy today.

AEROFIN is sold only by Manufacturers of Nationally Advertised Fan System Apparatus.
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YOU AND YOUR CUSTOMER will be better satisfied

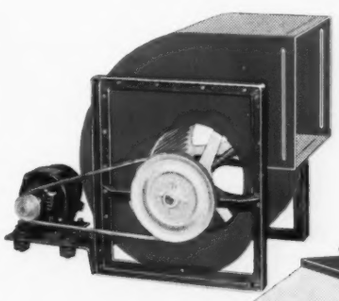
IF YOU INSTALL

HY-DUTY BLOWERS

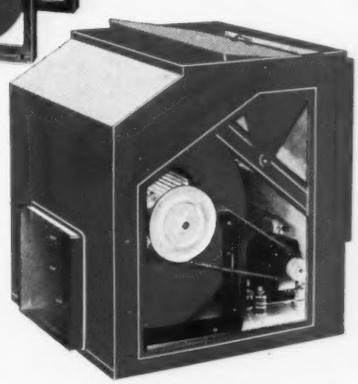
SUPERIOR FEATURES

MAKE THEM EASY TO SELL AND THEY STAY SOLD

- Rugged Construction
- Heavy Gauge Steel Throughout
- Balanced and Silenced
- Completely Rubber Mounted
- Attention Only Once a Season



Left: HY-DUTY *Attic Ventilator*



Right: HY-DUTY *Blower-Filter Unit*

The HY-DUTY FILTER UNIT is the most advanced unit obtainable. Its highly efficient air filter is all metal, needs cleaning only once a season and never needs replacing—an exclusive HY-DUTY refinement that ends too frequent servicing of filters and buying new ones.

Just a touch of your hand changes the position of the cabinet door for either vertical or horizontal duct installation. Your customer can switch over to an outside summer connection just as easily.

ATTIC VENTILATORS AND BLOWER FILTER UNITS carried in stock in full range of sizes, capacities and discharge outlet positions. Send for engineering information and catalog.

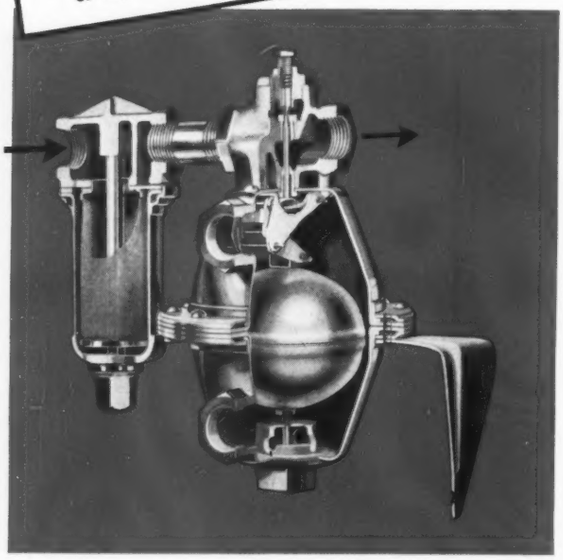
SCHWITZER-CUMMINS CO.
BLOWER DIVISION
FAN STREET.... INDIANAPOLIS, U.S.A.

You **ASKED** *for this Valve*

We KNOW, and we believe YOU know, that there is a vital need for a humidifier-pan, water-control valve that will work right and keep on working right. In fact, during recent years many furnace dealers, who recognize the dependability of the hundreds of McDonnell Water Level Controls applied to heating boilers, have called our attention to the need for an equally dependable control-valve for application to humidifier pans. Before building such a valve we carefully investigated the requirements, and found that they are as listed below. Check these needs against your own requirements and we believe that you will agree with us.

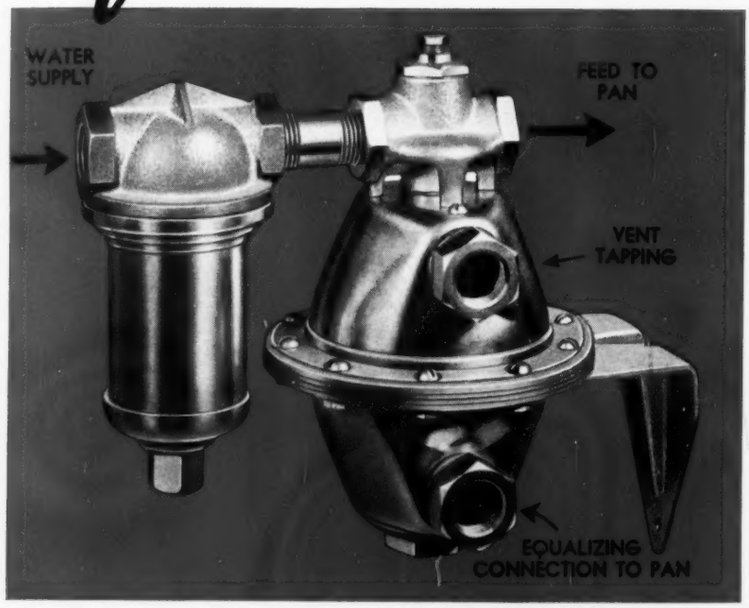
THE NEED

1. A valve that will not "lime up"—stick open or stick closed.
2. A valve that will handle any water pressure up to 150 pounds.
3. A valve that will give extremely close control of the water level in the pan.
4. A valve with sufficient capacity to maintain the water level in the pan at any rate of evaporation or vaporization.



And here is what it offers—

1. Will not stick—temperature of water at the valve never reaches the critical point at which lime and scale is deposited.
2. Since it does not lime up or stick, the pan it controls will never go dry or be flooded.
3. Water level in pan is held to extremely close limits. "Direct-flow" design—design that permits the city pressure to flow directly through the feed valve and into the pan—assures adequate capacity to maintain water level under all conditions. Will close tight against any water pressure up to 150 pounds. No reducing valve necessary.
4. Large bronze strainer—easily removed for cleaning—is a standard part of the valve. (Note illustration.)
5. Finest materials and workmanship throughout—compact—trim—a quality device that looks its part.



Here is our **ANSWER**

The requirements of a humidifier-pan, water-control valve were not new to us. Investigation of valves available for this purpose showed us that one of their worst faults—sticking or seizing of the valve as a result of lime and scale formation—was the same condition that we had met and overcome with the McDonnell "cool-feed-valve" (Pat. No. 1,934,486). The other requirements were also similar or identical to conditions that we had met during many years of specialization in the manufacture of water level control equipment.

On the solid foundation of this broad experience we have now developed the McDonnell No. 87 Humidifier Water Level Control Valve—and the illustrations, here, tell their own story of totally new standards in a valve of this type. Obviously this valve is more expensive than the ordinary kind, but as a result of elaborate tooling and efficient manufacturing methods, it is sold at a much lower price than you would expect to pay for a device that reflects uncompromising quality in every detail of design and construction.

WRITE FOR DETAILS—What will it mean to you to install a valve that will work right under all conditions—that will eliminate the service calls, the complaints, and the service expense? What will it mean to your customers? Surely it means enough to justify a careful investigation of the equipment and the experience behind it.

McDonnell & Miller, 1320 Wrigley Building, Chicago

"Doing One M&M BOILER CONTROLS *Thing Well"*

McDONNELL No. 87
WATER LEVEL CONTROL

Expressly designed for humidifier pans

Illinois Holds Reorganization Meeting

THE Illinois Sheet Metal Contractors' Association, which has been practically inoperative for the past three years, held a one-day meeting at Peoria, June 24. Some 400 invitations were mailed to contractors in all parts of the state for the primary purpose of getting sufficient attendance to ascertain whether or not the Association should be revived and again become active in state affairs. Contractors from Springfield, Peoria, the Chicago area, Danville, and several smaller cities in the northern and north central part of the state attended.

The concensus of opinion of the contractors was that the state association should be revived in order that a central clearing house can be maintained to co-ordinate the efforts of local associations and the efforts of contractors in communities where no local association now exists. A slate of officers and directors was elected and the necessary committees appointed to undertake reorganization of the association.

General Plan

There was an encouraging attendance of salesmen and manufacturers' representatives, and upon the recommendation of Paul R. Jordan, executive secretary of the Indiana association it was decided to form the new association along the lines of two allied branches—one to consist of contractors and the other to consist of manufacturers' representatives and salesmen. Following suggestions by Mr. Jordan, it was decided that the contractors will attempt to secure membership for the manufacturers' representatives and in turn the manufacturers' representatives and salesmen will stage a membership drive among contractors of the state.

Of some interest to those attending was the report of the treasurer to the effect that more than $470 is in the treasury. As a result of this report a motion was made and carried that contractors will be offered membership in the association without the payment of any initiation fees or dues until April, 1937. This permits contractors to join the association for the period April, 1936, to April, 1937, without the payment of dues. Dues for the year beginning April, 1937, will be payable in or before April, 1937, and will not exceed $6.00 per year.

Better Business

George Harms, F. Meyer & Bro., who has always been very active in the Illinois Association affairs, declared that the time seems ripe at present to revive the organization. He based his assertion upon the fact that reports indicate a rapidly growing residential building boom in many cities of the state, as for example, in Peoria and East Peoria where hundreds of small houses have been completed or are under construction. Mr. Harms also reported that commercial remodelling seems to be gaining headway in many cities which will undoubtedly result in a considerable volume of sheet metal, heating and ventilating work. Mr. Harms also declared that the association can be of service in any effort to solve the problem of mechanic shortage. He indicated that in Peoria, mechanics are getting a wage of $9 a day and that it is impossible to secure a satisfactory supply of good mechanics. He reported that many of the old timers who dropped out of active work several years ago have been reemployed in order that sheet metal shops can handle the work now on hand.

OFFICERS

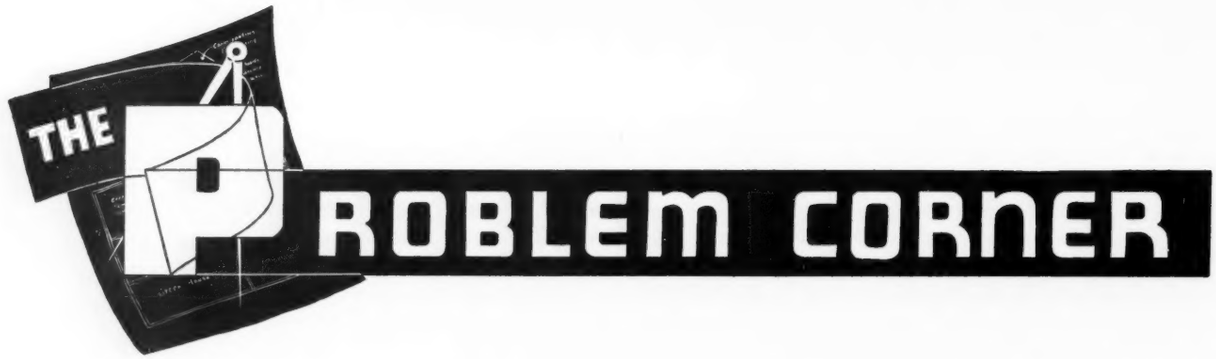
President, Charles Radtke, Peru.
Vice-President, Ralph Poe, Canton.
Secretary, Charles Soedler, Peru.
Treasurer, Frank Eynatten, Peoria.
Directors: Griff George, Springfield; John Maier, Chicago Heights; Joe Walters, Ottawa.

Indiana's Plan

The chief discussion of the meeting was under the direction of Paul R. Jordan of the Indiana association. He explained the organization in Indiana, which consists of eleven districts with annual meetings every other year. In this way, five districts and Indianapolis hold a district meeting each year. Mr. Jordan declared that for the past several years, indications point to the fact that a successful association must be chiefly educational in its program. An association can not fix prices, can not compel members or contractors to join, but must offer a definite educational advantage. As a second requisite, Mr. Jordan declared that an association today must be universal in scope and application; it can not cater to any particular clique, it must include big shops and little shops, union shops and non-union shops, poor and well financed shops, honest and crooked shops. Mr. Jordan declared that the experience in Indiana has proved that as a general rule sheet metal and furnace contractors are inherently honest, and they do abide by any promise made.

Mr. Jordan made the interesting assertion—"Associations are often looked to as the best source of assistance in breaking the vicious circle of decreasing prices and price competition." He asserted that the only way in which an association could assist in getting better prices for work was through general education and through the getting together of contractors and members in order that they become better acquainted with their competitors.

As a result of Mr. Jordan's discussion, George Harms made a motion, which was passed, that Illinois be divided into ten districts with headquarters cities in Quincy, Chicago, the Fox River Valley, Danville, Peoria, Springfield, Alton, Rockford, Peru or La Salle, Rock Island, and that the Board of Directors at its next meeting be empowered to ascertain the boundaries of these districts, and determine just where associations are organized or active and how best a district organization can be set up within the Illinois state association. The Board of Directors will also be empowered to arrange for the place and date of district meetings, the purpose of which will be to revive interest in the Illinois association and its suggested district organization.



Infiltration

G. A. Voorhees,
American Artisan:

I have read with interest your splendid article in the February American Artisan and the explanation is clear excepting one point. I am not familiar with leakage loss and taking your typical room as an example, I find that to the cubic content I add 50 per cent which must be for infiltration. I cannot find anything in the Mechanical Code covering this. Would this addition apply to first floor rooms?
A. A. H., Ontario, Canada.

Reply by
G. A. Voorhees,

It's true that Table 1 of the Mechanical Heating Code recommends that the amount of infiltration be assumed to be 1½ × the cubic content of the room, if it is a "living room" having windows in two sides, whereas it specifies only one air change per hour for sleeping rooms.

In reality, so far as the amount of air entering a room by infiltration is concerned, it doesn't matter whether that room is a living room or a sleeping room. If the "cubic content method" of estimating infiltration is used, it is better to assume that, **regardless of the use to which the room is put,** the leakage or infiltration will amount to 1½ air changes per hour if the room has windows in two sides.

It is the practice of some heating men to estimate only one air change per hour, due to infiltration in sleeping rooms because the occupants of the house are usually not so concerned about maintaining as high a temperature in bedrooms as in the principal living rooms. Consequently, if the actual heat loss due to infiltration is greater than would result from the assumption of one air change per hour, the slight reduction in room air temperature would probably not be objectionable in a bed room.

Following are some general thoughts regarding infiltration which may be of interest to you.

The dimensions of surfaces through which transmission heat losses take place, can usually be measured directly from the building itself or from plans drawn to scale, but when we come to infiltration heat losses, we can only **estimate** them.

Just what is infiltration?

For practical purposes we may think of it as outdoor air which wind pressure forces into a building through cracks around windows and outside doors. It is customary to measure it in cubic feet of air per hour.

With that definition as a basis, several conclusions may be reached. Certain other facts must necessarily be considered along with the definition itself, to arrive at the conclusions logically. But these facts are more or less self-evident and to save space will be made to build up a logical claim of reasoning.

Now for the "conclusions" regarding infiltration:

(a) Since infiltration is due to wind pressure, it takes place only on the windward side or sides of the building.

(b) For the same reason, infiltration can take place on not more than two sides of the building at any one time.

(c) The side or sides of the building where infiltration occurs will depend on the direction of the wind. It will vary from day to day or from hour to hour.

(d) The filtration depends on the velocity of the wind. The harder the wind blows, the greater the outside pressure built up on the windward side of the building, and the greater this air pressure, the greater the volume of outside air forced into the building through cracks and crevices.

(d) For every cubic foot of outside air entering on the windward side (or sides) of the building, an equivalent volume of air must escape from the building somewhere. This air leaving the building is frequently referred to as "exfiltration." It is usually assumed that it takes place through the window or door cracks on the leeward side of the building.

(f) The volume of air entering by infiltration (or leaving by exfiltration) depends on the aggregate area of the crack opening; or as it is more commonly expressed, on the average width of the crack and the number of running feet of such crack of a certain average width.

These few, out of the very many conclusions that may be reached regarding infiltration, will suggest to the thoughtful reader how complex the problem is and how utterly impossible it is to determine by calculation, the **precise** volume of air that will enter any given room in this way.

The problem is further complicated by the fact that in addition to the air entering between the window sash and its frame, there may be a further leakage between the frame and the wall in which it is set. There is also a measurable air leakage through the structure of the wall.

Open fireplaces have a strong tendency to cause infiltration even when there is no perceptible wind blowing. The suction of the fireplace chimney withdraws large volumes of air from the room—and air cannot be taken **out** of a room unless somehow, somewhere, an equivalent volume of air is admitted **to** the room to replace that withdrawn by the flue. The resulting suction applied to the room air draws outside air into the room through window and door cracks. Results: more infiltration.

Since most infiltration takes place through cracks around windows and outside doors it seems logical to use the width and length of these cracks as a basis for estimating the volume of infiltering air. And this "crackage method" is used by many engineers—but the final result is only **an estimate** —too many variables are involved to make it anything else.

Since ANY practical method of figuring infiltration is no more than an estimate, it is desirable to adopt some method which has the following characteristics:

First: The chosen method should be one that is easily and quickly applied.

Second: It should contain a reasonable factor of safety.

In formulating the Standard (Gravity) Code and the Mechanical Heating Code, the majority of the committee felt that the "Air Change Method" most nearly met these requirements. This does not mean that the members

The Problem Corner . . . . .

were unanimous in reaching that decision. Many engineers have, through experience, developed strong prejudices for or against, any and all of the conventional methods.

The easily applied "air change method" assumes that the volume of air entering a given room by infiltration, will bear a more or less definite relation to the cubic volume of the room. If the volume of infiltering air during one hour is approximately equal to the cubic content of the room, the infiltration is said to amount to "one air change per hour," etc.

Table I in Article 2, Section I, of the Mechanical Heating Code is a simple form of such a table of air changes per hour due to infiltration. Following is a more complete table from Harding and Willard's "Mechanical Equipment of Buildings" Volume I:

Kind of Room or Building	Number of Air Changes Taking Place per hour
Rooms, 1 side exposed	1
Rooms, 2 sides exposed	1½
Rooms, 3 sides exposed	2
Rooms, 4 sides exposed	2
Rooms, no windows or outside doors	½ to ¾
Entrance Halls	2 to 3
Reception Halls	2
Living Rooms	1 to 2
Dining Rooms	1 to 2
Bath Rooms	2
Drug Stores	2 to 3
Clothing Stores	1
Churches, factories, lofts, etc..	½ to 3

In using any such table we must keep in mind that if two rooms have exactly the same dimensions and therefore the same cubic content, the one with the greater number of windows and outside doors, will tend to have greater infiltration.

Table 1 of the Code and the more extended table above are only **suggestions** as to the number of air changes due to infiltration, that should be used in determining the heating requirements of the various rooms.

Too many of us carelessly allow ourselves to accept such tables as fixed, invariable rules. There is no objection to thinking of them as rules if we remember that they are **flexible** rules, capable of modification to meet varying conditions.

Just because a room has three sides, exposed doesn't mean that it must **necessarily** have an infiltration of two air changes per hour It might have one air change or it might have three.

We've got to consider, among other things, the tightness of the building construction—not only the tightness of windows and doors, but also the condition of the walls. There's a rapidly growing number of quite old houses which are being equipped with mechanical heating systems. Some of them were none too well built to start with, and age hasn't improved them.

Frame walls without wind-sheathing, without building paper; walls that have settled and cracked—all these things affect infiltration and we must learn to watch for them. The "pipeless furnace age" has passed. Our customers demand—and have a right to expect, better heating systems. And the foundation of any first class heating system is intelligent determination of the heat requirements of the various rooms.

Be especially careful about Bath Rooms. Many of them contain only about 400 cubic feet of space—and some less than that.

We don't like to recommend "Thumb Rules" but here's an exception:

Never figure less than 1,000 cubic feet of infiltration for any bath room.

Table 1 of the Code, Third Edition, which suggests the number of air changes to allow in figuring infiltration, doesn't mention Bath Rooms, but the maximum number of air changes suggested for any room is two per hour.

Now if we have a Bath Room 5′ 0″ × 8′ 0″ with an 8-foot ceiling, its cubic content is 320 cubic feet. Two air changes per hour would be only 640 cubic feet per hour assumed for infiltration—and many a bath room window will admit more than 640 cubic feet of air per hour.

The flat assumption of 1000 cubic feet per hour as a minimum for a bathroom may be (and is) a little too high in some cases—but if there's any room in the house that should be warm it's the bath.

As a rough check on the "Air Change Method of estimating infiltration, some heating men assume a leakage of 750 or 800 cubic feet of air per hour around the "average" window and 1500 or 1600 cubic feet per hour around the "Average" outside door. This of course, doesn't fit windows of unusual size. If a window is larger or smaller than the "average" the assumed leakage must be increased or decreased. Further allowance must be made by reducing the volume for weatherstripped windows and doors, and by increasing it for unusually loose construction. The most that can be said for this method is that it is convenient for checking up quickly on estimates made by one of the other methods.

Theoretically the "Crackage Method" of estimating infiltration is the most accurate available because it is supposed to take into consideration the width and the number of running feet of crack around windows and outside doors. In actual practice, many engineers claim that the final results are no better than the simpler "Air Change Method."

If a room has three sides exposed, it is quite evident that normal wind pressure can be exerted against only two of those sides at any one time, and the sides through which infiltration will take place will vary with a shift of wind direction. Therefore, we ordinarily measure only the number of running feet of crack around windows and doors in two walls which have the greatest length of such crack, and use this amount of crackage as the basis for the estimate.

The 1936 Edition of the "A. S. H. V. E. Guide" gives the following rule:

"In no case should the amount of crack used for computation be less than half of the total crack in the outside walls of the room. Thus, in a room with one exposed wall, take all the crack; with two exposed walls, take the wall having the most crack; and with three or four exposed walls, take the wall having the most crack, but in no case less than half the total crack."

For use with this rule, the Guide gives the leakage **per running foot** of crack double hung wood sash windows, as follows with a wind velocity of 15 miles per hour:

Total cubic feet per hour for average window nonweatherstripped	39.3
Same, weatherstripped	23.6
Total cubic feet per hour for poorly fitted window, nonweatherstripped	110.5
Same, weatherstripped	34.1

Infiltration through door cracks may be assumed to be twice that through window cracks.

The number of running feet of crackage can be easily determined in measuring-up to a building when making a heating or air conditioning survey. When data is taken from architects' plans, the measurements can be taken from the elevations of the building which show windows drawn to scale. But when working from floor plans only, on which window sizes are shown in the conventional manner by designating the dimensions of the glass panes and indicating the number of lights, it is somewhat of a task to figure out the number of running feet of crack.

◆

Eratum

On page 85 of the April issue under the "Problem Corner" in the reply by William Scott of Bradfordwoods, Pennsylvania, on the question of using part outside air in the fourth and sixth line of the third column, a times sign was used in place of the unknown quantity designated "X". Readers using the proportion equation are requested to use X instead of times.

The Minneapolis Heating, Ventilating and Air Conditioning Ordinance [Part 9]

Installation of Burners and Controls

Section 1508. General: Gas burners of all types shall consist of factory assembled and tested units and shall be accompanied by complete and comprehensive installation and operation instructions.

Section 1509. Burners: The burner or burners shall be located according to the manufacturer's instructions and shall be securely fastened in place to prevent twisting, sliding or dropping out of position.

1509.1 The burners shall be so installed as to be readily accessible for cleaning and inspection.

1509.2 The burner or burners shall be so installed that no part of the flames impinge so as to cause incomplete combustion.

1509.3 Air shutters shall be adjusted to produce a good flame at the prevailing gas pressure.

Section 1510. Secondary Air Openings: Where secondary air is necessary, secondary air opening or openings shall be provided, of sufficient area to supply an adequate amount of air for complete combustion.

1510.1 Where an automatic secondary air control is provided the construction shall be such that, in case the control fails in any way, either the gas will be shut off or the secondary air door will remain open.

Section 1511. Pilots: Either a thermostatic pilot, so constructed and adjusted that no gas can flow through the main burner unless the pilot flame is burning, or some other similar type of safety device serving this same end, shall be employed. The operation of this safety device shall not depend on the closing of an electric circuit to shut off the main gas supply.

1511.1 Pilot burners shall be supported in such a manner that their position relative to the main burner or burners will be fixed.

1511.2 Pilot burner or burners shall be so placed that they can be safely lighted and they shall be readily accessible or removable for cleaning.

1511.3 Pilot lines shall be connected to vertical main gas supply lines or to the side or top of horizontal lines ahead of all controls except pressure regulators, and shall be susceptible to independent control.

Section 1512. Main Shut-off Valve: A manually operated shut-off valve shall be installed at each appliance to shut off the entire gas supply to the appliance in cases of emergency.

1512.1 Such valve shall be so located that it is readily accessible and shall clearly indicate the "on" and "off" positions, or direction of rotation to open or close.

Section 1513. Electric Control Valves: Electric control valves shall be installed according to the instructions furnished by the manufacturer.

1513.1 All electrical connections shall be made in conformity with the provisions of "An Ordinance Regulating the Installation, Operation and Maintenance of Electric Wires, Apparatus and Plants within the City of Minneapolis," approved April 1, 1922, as subsequently amended.

Section 1514. Gas Pressure Regulators: A gas pressure regulator shall be installed on all gas burner installations.

Section 1515. Limiting Devices: The boiler or furnace shall be equipped with safety devices arranged to limit high steam pressures or water temperatures, as well as high air temperatures in warm air furnaces.

1515.1 It is recommended that, on a steam or vacuum vapor boiler, means be provided to guard against firing a dry boiler or one in which the water is dangerously low.

1515.2 Safety devices operated electrically shall not depend upon the closing of a circuit to shut off the main gas supply. This requirement shall not be construed as prohibiting the use of electrical regulating devices, provided the required safety devices are also installed.

Section 1516. Forced Primary Air Control: When air under pressure is used in connection with the gas supply, effective means shall be provided to prevent the air from going back into the gas piping.

Section 1517. Piping: All gas piping installed for the service of the gas burners to be used in connection with any heating system shall be supplied by an independent line direct from the meter and shall be installed in conformity with the provisions of "An Ordinance to Regulate the Installation of Gas Piping for Illuminating or Fuel Gas and the Installation, Alteration, Maintenance and Use of Gas Burning Devices Connected Thereto, and Repealing a Certain Ordinance," approved ———, 1935.

Section 1518. Adjustment of Burners: After the piping has been thoroughly purged, the pilot burner shall be lighted and adjusted and the burners put into operation in accordance with the manufacturer's instructions.

INSPECTION AND TESTS

Section 1519. Pilot Operation: Pilot flames shall effectively ignite the gas at the main burner or burners and shall be adequately protected from drafts. A device which is at least equal in performance to the draft hood hereinbefore provided for shall be interpreted as fulfilling the second part of this requirement as far as chimney drafts are concerned.

1519.1 Pilot flames shall not become extinguished when the main burner or burners are turned on or off in a normal manner, either manually or by automatic controls.

1519.2 Luminous flame pilots shall not show carbon deposits when adjusted according to the manufacturer's instructions.

1519.3 Where escapement pilots are used, their flames shall be freely ignited by the constant burning pilot.

Section 1520. Burner Operation: In making the tests to determine compliance with Sub-sections 1522.1, 1522.2 and 1522.4 great care shall be exercised to prevent the accumulation of unburned gas in the appliance or flues which might result in explosion or fire.

1520.1 The flames from each burner shall freely ignite the gas from adjacent burners when operating at the prevailing gas pressure or when the main control valve is regulated to deliver about one-third (⅓) the full gas rate, except where additional pilots are provided.

1520.2 Burner flames shall not flash back upon immediate ignition, nor upon turning the gas cock until the gas rate to the burner is about one-third (⅓) the full supply.

1520.3 Burner flames shall not flash back when the gas is turned on or off by any automatic control mechanism.

1520.4 Main burner flames shall ignite freely, from each constant burning pilot, when the main control valve is regulated to deliver about one-third (⅓) the full gas rate.

1520.5 When ignition is made in a normal manner, the flames shall not flash outside the appliance.

1520.6 Burners shall not expel gas through air openings in mixer faces when operating at the prevailing pressure.

Section 1521. Appliance Operation: The concentration of oxygen in the flue products shall, in no case, be less than four (4) per cent, nor more than ten (10) per cent.

1521.1 Method of Test: The rate of flow of the gas shall be adjusted to within plus or minus five (5) per cent of the required hourly B. T. U. input rating at the manifold pressure specified by the manufacturer. When the prevailing pressure is less than the manifold pressure specified, the gas rate shall be adjusted at the prevailing pressure. The appliance shall be allowed to operate until the stack temperature becomes stabilized, after which a sample of the flue products shall be taken at a point in the flue after the outlet of the appliance but ahead of the draft hood and analyzed for carbon dioxide and oxygen.

1521.2 The various controls of the appliance shall be checked by both inspector and installer, to insure their proper operation.

Section 1522. Instructions to the Customer: The customer shall be thoroughly instructed by the installer as to the proper and safe operation of the appliance before it is placed in continuous service.

1522.1 Suitable printed instructions shall be supplied by the installer and posted in a prominent position near the appliance.

Section 1523. Permits: The requirements as to the securing of permits for the installation of gas burners, gas burner equipment and piping shall be as set forth in Sub-Section 7.13 of an ordinance entitled, "An Ordinance to Regulate the Installation of Gas Piping for Illuminating or Fuel Gas and the Installation, Alteration, Maintenance and Use of Gas Burning Devices Connected Thereto, and Repealing a Certain Ordinance," approved—1935.

PART XVI
STOKER INSTALLATIONS

Section 1601. The arrangement, equipment and manner of installation of all stokers hereafter installed for use in connection with heating plants in or for buildings in the City of Minneapolis, and the alteration hereafter of all such stoker installations, shall conform to the following provisions:

Section 1601.1. Stoker Defined: The term "stoker," shall for the purposes of this ordinance be taken to mean a mechanical device for feeding solid fuel into the combustion chamber of a boiler or furnace used in connection with a heating plant, whether automatically or manually controlled.

Section 1602. Non-Automatic Stokers Not Allowed. When: Stokers which are not equipped with automatic means of preventing excessive pressures or temperatures of the heating medium shall not be installed or operated in any location where a competent attendant will not be constantly on duty on the premises while the stoker is in operation.

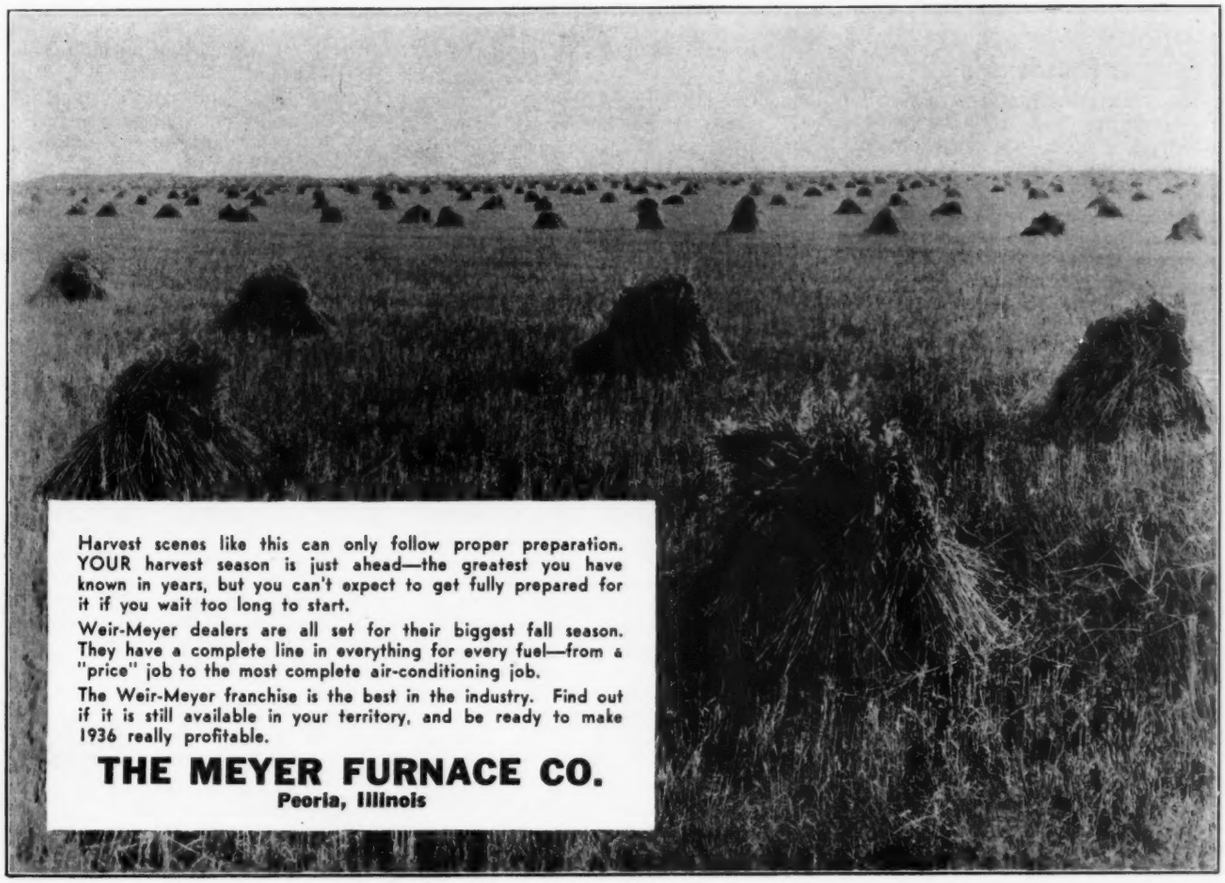
Section 1603. Automatic Controls: Except as provided in Section 1602 of this ordinance, each mechanical stoker shall be equipped with at least one (1) high limit control so connected as to shut off power from stoker drive in the event of excessive pressure in a steam boiler or excessive temperature in a hot water boiler or warm air furnace casing. Each steam boiler shall be equipped with a low water cut-off.

Section 1604. Electric Wiring and Equipment: Electric wiring and equipment in connection with stoker installations shall be installed in accordance with the provisions of "An Ordinance Regulating the Installation, Operation and Maintenance of Electric Wires, Apparatus and Plants within the City of Minneapolis," approved April 1, 1922.

Section 1605. Setting Heights and Combustion Space: The distance from retort to crown sheet and the space for combustion, within any heating boiler or furnace, shall be such as to secure efficient smokeless combustion and shall be in accordance with standard engineering practice and subject to the approval of the Inspector of Buildings.

Section 1606. Alterations to Combustion Chamber: Where stokers are installed in down-draft boilers, the

(*Continued on page* 98)


Harvest scenes like this can only follow proper preparation. YOUR harvest season is just ahead—the greatest you have known in years, but you can't expect to get fully prepared for it if you wait too long to start.
Weir-Meyer dealers are all set for their biggest fall season. They have a complete line in everything for every fuel—from a "price" job to the most complete air-conditioning job.
The Weir-Meyer franchise is the best in the industry. Find out if it is still available in your territory, and be ready to make 1936 really profitable.
THE MEYER FURNACE CO.
Peoria, Illinois

Cleveland

The Contractors Division of the Central Bureau for Heating and Air Conditioning in Cleveland is co-operating in a large impartial, air-conditioning educational booth at the Great Lakes Exposition. The exposition is to run for 100 days from June 27 to October 4, inclusive. Twenty prominent manufacturers of heating and cooling equipment have contributed to make this booth possible. The booth is under the management of Eugene P. Farris, managing director, Central Bureau for Heating and Air Conditioning, and acting as general chairman of the air conditioning industry. Contractors visiting the Cleveland exposition are cordially invited to visit the booth and to make it their headquarters while in Cleveland.

◆

Philadelphia

The "Certified Roofers" advertisement appearing in the Philadelphia daily paper in the classified advertising section has brought in over fifty jobs and a large number of telephone and letter inquiries from the public. As pointed out in the June issue of AMERICAN ARTISAN, this advertisement is published as a co-operative effort of the association. The advertisement stresses the supervision and inspection as a result of which a very large proportion of the inquirers desire information on the supervision and inspection. The association feels that this interest in inspection indicates a desire on the part of the public to have better and more lasting jobs.

The association feels that so much good has been obtained from the small advertisement that it probably will be continued for the balance of 1936.

To back up the advertisement, the association has prepared a small leaflet which is mailed to inquirers entitled "Beware of the Cheap Roof." The leaflet points out some of the unwelcomed results from buying "cheap" roofs. Information is also given on the roof guarantee which is not backed by a responsible firm. Emphasis is laid upon the fact that the certified roof of the association is backed by responsible firms of long experience and by the association as a body. The leaflet explains that roof construction followed approved practice and standards and uses only quality material. Space for the roofer's imprint is provided on the leaflet.

In the educational effort now under way, the association is emphasizing the importance of actual experience as a basis for successful salesmanship. The educational course, covers the complete design of gravity and mechanical warm air heating systems and air conditioning jobs and is designed to equip the contractor or salesman to use this engineering experience in his sales talk. Actual jobs are figured and test houses are under consideration.

F. U. Ritter,
Secretary.

◆

Indiana

The District Meeting of the Lafayette District (Indiana) was held at the Crystal Springs Club House near Lafayette. It got under way early in the afternoon and kept gathering impetus and numbers until dinner time. The afternoon picnic was pleasantly informal, with horse shoes, drinking and plain and fancy lying. The favorite beverage was the spring water which was so cold and refreshing as to elicit favorable comment from all of the guests. The drinking contest was won by Pop Voorhees who, after enveloping gallons of spring water, stepped into the lead by partaking of one coca cola. The lying contest was won by Hubert Jones. The prizes were donated by J. A. Harris and consisted of blotters which had been given to him from time to time by outside concerns.

The dinner was characterized by plenty of fish of exceptional quality, and other epicurean specialties all up to Louis Lehnen's high standard. The dinner was followed by a dissertation by a gentleman who introduced himself as a Holland salesman, but whose exact identity still remains a secret. He turned out to be a very original comedian who could mix card tricks and ventriloquism with razzing of the contractors.

Short talks were given by Paul Austin, J. A. Harris, Jos. C. Gardner, R. C. Gustafson, Frank L. Myers and O. Voorhees. Pop Voorhees, supplemented by Frank L. Myers, briefly presented the plan for a National Warm Air Heating and Air Conditioning Week.

Mr. Buck and Mr. Talbott of the Minneapolis-Honeywell Regulator Company put on an interesting and constructive program on controls. The meeting was in charge of Carl Butz, District Governor. Louis Lehnen presided. The Furmets showed to better advantage in attendance than they did at the former meeting, but the contractors were still 40% ahead of them.

Paul R. Jordan,
Executive Secretary.

◆

Indiana

The Fort Wayne District of the Indiana State Association, under the direction of district governor Charles B. Rundell, staged an interesting and informative meeting recently. Chairman Rundell advocated the industry's abandoning the word "tinner" and substituting therefore, the words "sheet metal contractor," or "warm air heating contractor." A motion was made and carried that the word "tinner" be dropped and the two suggested names above be substituted therefore.

An educational film furnished by the Minneapolis-Honeywell Regulator Co., under the supervision of District Manager B. C. Simons, provided information on heat control, and the progress in control systems.

At a joint session of the Board of Directors of the State association and the officers of the Fort Wayne association, plans were discussed for an air conditioning school to be held one night each week for a period of six or eight weeks. Members of the Indiana State association would be enrolled free of charge. There will be a nominal tuition fee for non-association members. The plan most favored is for the Fort Wayne association to take charge of enrollment and the State association to take charge of the program.

Charles B. Rundell,
District Governor.

Association Activities . . . . .

Fort Wayne

The Sheet Metal and Warm Air Heating Contractors' Association of Fort Wayne, Indiana, has elected the following officers for the coming year: Carl V. Miller, President; A. E. Rose, Vice President; Charles E. Tharp, Secretary; John C. Kreidt, Treasurer; C. L. Schust, J. W. Loney and Fred Miller, trustees.

Charles E. Tharp,
Secretary.

◆

Chicago

The Air Conditioning and Warm Air Heating Institute of Illinois at its July 7 meeting decided that the movement had progressed to the point where an effort should be made to determine just how many contractors are ready to pledge or contribute their fees and dues so that the proposed radio advertising program can get under way.

Accordingly, suitable pledge cards will be printed immediately and mailed with a letter of explanation to a large number of firms within the broadcast area. Firms not receiving a letter and card within the next three weeks and interested in the movement should write secretary Louis Drehoble, 4978 Milwaukee Ave., Chicago.

New York

The Employers' Association of Roofing & Sheet Metal Workers of Greater New York at its May 7 meeting, devoted the program to roof insulation. The Insulite Company was host at a dinner which preceded the meeting. President J. L. Fisher introduced several speakers, among them M. G. Jensen, Sales Manager of the Insulite Company, who discussed in detail the history of insulation and the opportunity offered roofers to enlarge their business. Barclay Beaver of the New York office of Insulite furnished the discussion which accompanied a moving picture showing the production of Insulite. F. J. O'Connor of Washington, D. C., explained the proper procedure in handling government bids. He also explained the extent of insulation in construction of Federal buildings George Brown, chairman of the association executive committee, made a plea for increased membership.

◆

Queens, N. Y.

The Queens Roofers, Resiers and Sheet Metal Contractors' Association, at their May 27 meeting, invited jobbers of roofing and sheet metal supplies in order that the association might outline practices which they believe constitute unfair competition. The association believes that a jobber should be a jobber and a contractor should restrict himself entirely to contracting. The association is definitely opposed to jobbers competing with contractors either directly or indirectly by financing or extending unwarranted credit to free lance mechanics and salesmen, and supplying merchandise at competitive prices to those individuals who are not contractors. As a result of this meeting, it is felt that better relationship will exist between jobbers and contractors and that some of these unfair practices will be eliminated through co-operative effort.

S. CLINTON STERN,
Executive Secretary.

◆

Hardware

The Forty-second annual convention of the National Wholesale Hardware Association and the American Hardware Manufacturers' Association is to be held at Atlantic City, New Jersey, Monday, October 19 through to Thursday, October 22nd, with headquarters at the Marlborough-Blenheim Hotel.

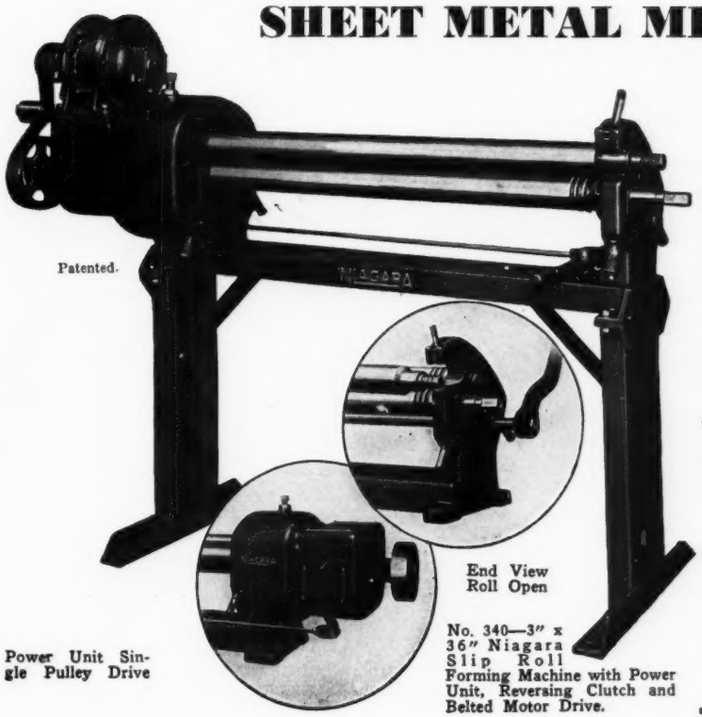
Official Boards of both associations recommended that the 1937 convention be held in the Middle West.

GEORGE A. FERNLEY,
Secretary-Treasurer.
The National Wholesale Hardware Association.

NIAGARA SLIP ROLL FORMERS

Make Money for

SHEET METAL MEN



End View Roll Open

Power Unit Single Pulley Drive

No. 340—3" x 36" Niagara Slip Roll Forming Machine with Power Unit, Reversing Clutch and Belted Motor Drive.

Sheet Metal Men are manufacturing light and heavy pipe, stacks, drums, pail, tub and container bodies with Niagara Slip Roll Formers. The No. 340 Power Driven Model shown at the left is just one of the complete line of power and hand operated models made in light and heavy sizes for different thicknesses of material and various working lengths.

Finger operated quick trigger mechanism releases slip roll in a jiffy for removing the work. Slip roll swings open and closed without lifting. Rolls are adjustable for producing desired curvature.

Mail coupon for Bulletin illustrating and describing exclusive and patented features which make these Niagara machines make money for sheet metal men.

Niagara Machine & Tool Works
683 Northland Ave., Buffalo, N. Y.

Please send Catalog on Slip Roll Formers, also ☐ Folders ☐ Shears ☐ Groovers ☐ Machines for Turning, Beading, etc.

Name .....

Concern .....

Street ..... City.....AA7

Actuated by TEMPERATURE...NOT by TIME

COMPENSATED

balanced regulation

BARCOL CONTROL BARCOL

Furnace Regulator

THE BEST IN EVERY WAY

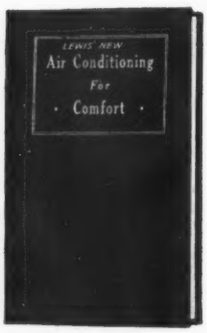
In Accuracy . . . Durability . . . VALUE . . . the Barcol Furnace Regulator tops them all! Designed by experienced automatic temperature control engineers and made of best materials and finest workmanship for lasting service, this unit has EVERYTHING! Fits any type of heating system in any kind of residence. Packed in kit complete with all necessary accessories. Send today for circulars and prices.

DEALERS . . . INVESTIGATE !

Your customers have more money to spend . . . and they are becoming control-conscious! Don't miss this opportunity to cash in on some nice profits . . . get ready NOW for the coming heating season!

BARBER-COLMAN COMPANY
Rockford • Illinois

KNOW
AIR CONDITIONING



Learn every phase of this important subject by sending today for a copy of

LEWIS' NEW
"Air Conditioning for Comfort"
by SAMUEL R. LEWIS

277 *Pages*—$2.50
Large Psychrometric Chart

So understandably does this new volume cover all angles of air conditioning that already dozens of schools teaching air conditioning have adopted it as a text. From it anyone may quickly acquire a thorough knowledge of equipment, psychrometry, refrigeration, humidification, dehumidification, heat transmission, heat absorption, air distribution, and water circulation. It also explains every step in the design of a complete heating and cooling system for a typical residence and a typical commercial building.

Send $2.50 for a copy today. You may return the book and your money will be refunded promptly if it does not prove satisfactory in every way.

KEENEY PUB. CO. • 6 N. MICHIGAN • CHICAGO

News Items . . . . . .

U. of I. Installs Complete Condition System

The University of Illinois, Department of Mechanical Engineering, announces that a complete central station type air-conditioning plant to be used as laboratory equipment by undergraduates in the regular heating, ventilating and air-conditioning courses and, to also be available for research work is being installed during the summer. The compressor is a 14-ton "Freon" machine, and the fan will have a capacity of 3,000 cfm. The plant is so designed and apparatus so arranged that almost any type of operation—air washer, direct expansion, spray and surface cooling, winter-conditioning—may be used for research or demonstration purposes. Glass panels are being installed throughout the system so that the complete operation may be watched. There will be complete accessory equipment and controls so that almost any type of operation is possible.

◆

Bernstrom Opens Engineering Office

B. Bernstrom, air conditioning consulting engineer, has opened an office at 844 Rush Street, Chicago. Mr. Bernstrom is well known to the trade following several years service as chief engineer for the Furblo Company, Hermansville, Michigan.

◆

New Firm in Bay City, Michigan

J. W. Gray and E. C. Henry announce the formation of The Gray-Henry Co., a new firm to operate in Bay City and Midland, Michigan. The firm will handle a complete line of heating and air conditioning equipment. Among the manufacturers represented will be General Electric Company including the air conditioner, the direct-fired oil-burning warm air conditioner, cooling and ventilating unit; Bryant Heater Company, with direct-fired gas warm air conditioner; Dail Steel Products Company, the Dailaire steel coal fired conditioner. In addition to heating apparatus the company will also handle house insulation and water softeners.

A complete showroom and shop at 228 East Main Street in Midland and at 614 North Water Street in Bay City, will be maintained.

◆

Babush Represents Brundage

Joe Babush is representing the Brundage Co., Kalamazoo, Michigan, manufacturers of furnace blowers with offices in Milwaukee. Mr. Babush will contact the dealer and jobber trade of northern Illinois and southern Wisconsin.

◆

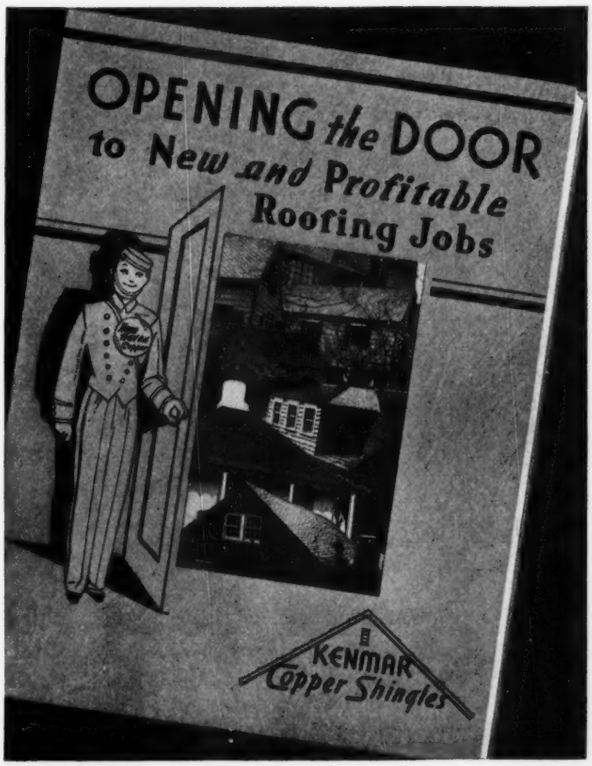
Holliday Celebrates 80th Anniversary

W. J. Holliday & Co., Indianapolis, Indiana, jobbers, celebrated the 80th anniversary of their founding with a show in their offices designed to acquaint fabricators in their district with the uses of various metals. Some forty firms whose goods are distributed by Holliday participated with displays. The exhibit of the American Rolling Mill Co., Middletown, Ohio, featuring stainless steels and their applications, won first prize.

◆

Stowell Promotes Furnace Cleaning

Jack Stowell, 133 Galena, Aurora, Illinois, is distributing to home owners a mimeographed sheet, accompanied by a business reply card, inviting them to have one of his trained men call. The announcement calls attention to a special offer for furnace cleaning during June and July.



If you could see the stacks of letters from all parts of the country inquiring about Kenmar Shingles, you'd agree that here is the chance of a lifetime for progressive sheet metal contractors interested in new and profitable business.

Write for Sales Portfolio

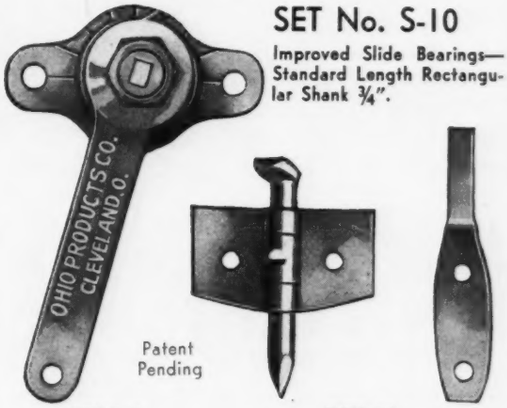
Our Portfolio for Sheet Metal and Roofing Contractors tells all about Kenmar Copper Roofs; what we are doing to promote interest in better roofs; and how we help you get your share of this profitable new business. Get in on this new opportunity early. Write for details today.

The New Haven Copper Co.
MANUFACTURERS OF SHEET COPPER SINCE 1849
Seymour, Conn.

Simplex . . .
DAMPER REGULATORS

FURNACE Men . . . here is the solution to all your damper regulator problems . . . the revolutionary, entirely new SIMPLEX Damper Regulator which contains all the features you have been wanting for years! There is nothing like it on the market. . . . Just check and see for yourself!

- Positive lock
- Knurled and creased, not friction held
- Made of steel and unbreakable
- Positively air tight
- 180° adjustable
- Damper position self-indicating



STYLE S TYPE 10

SET No. S-10

Improved Slide Bearings—Standard Length Rectangular Shank ¾".

Set No. S-10—Packed 12 complete sets in a box.
Each box contains:
12-S Simplex Regulators.
12 Pair Simplex Improved Slide Bearings with Metal Screws and Rivets. (Screws, Rivets and Bearings in small envelope.)
1 Wrench.

Why not write today for literature on this new foolproof damper? Send us the name and address of your jobber and we'll send you a sample damper together with literature and price list.

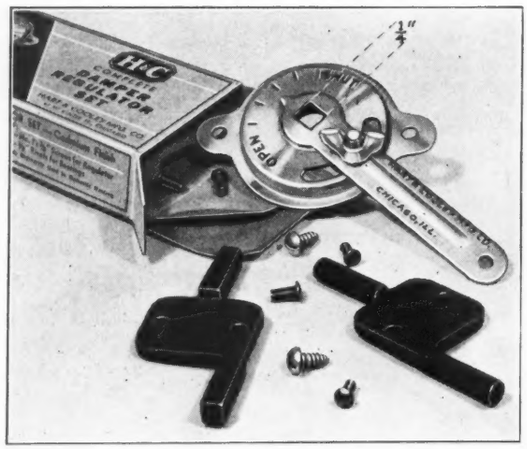
Don't delay. Fill out the coupon now and scoop the other furnace men in your neighborhood.

OHIO PRODUCTS COMPANY
17606 Milburn Avenue, Cleveland, Ohio

Please send me the price lists and literature and also the sample damper. I enclose jobber's name and address.

Name .....
Address .....
Jobber's name .....
Jobber's address .....

For Greater Convenience and Better Installations at No additional Cost-



Use H&C DAMPER REGULATOR SETS

The patented combination bearings furnished with every H & C Damper Regulator set are the greatest convenience ever incorporated in Damper Regulator Equipment! By simply reversing their position they serve equally well with either regular or splitter dampers. This feature saves time and cuts in two the number of sets necessary to stock.

That, however, is only one of several reasons why you should use H & C Damper Regulator Sets. They're sturdier, better built in every detail, furnished complete, with everything required for installation—each set in a strong carton to positively assure all parts being on hand when needed. And yet they compare favorably in price with the most ordinary sets on the market. Why not avail yourself of the greater convenience and better value they offer? Inspect them at your H & C Jobbers or write for free sample.

Made in 1/4" (No. 70 1/4) and 3/8" (No. 70 3/8) Sizes.
Separate parts furnished as ordered.

HART & COOLEY MANUFACTURING CO.
Warm Air Registers · Air Conditioning Grilles
Regulator Sets · H&C · Dampers · Chain
61 W. KINZIE ST. · CHICAGO · ILLINOIS
In Canada: Fort Erie N., Ontario

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 89.

292—Roof Ventilator

The American Larson Ventilating Co., 1004 Keystone Bank Building, Pittsburgh, Pennsylvania, is distributing a 16-page catalog covering the American Larson Roof Ventilator for industrial, marine, residential and public structures, containing a detailed description for both the technical and non-technical reader of the features of the American Larson ventilator.

The company claims their ventilator will start air moving through the ventilating duct in wind velocities from one to five miles per hour, thus supplementing and correcting stack action; and that under no condition does it permit down-draft.

The American Larson Inlet Ventilator is also illustrated and described. This apparatus performs the opposite function to the exhaust ventilator and provides a source of intake for fresh air in a structure.

◆

293—Furblo Institute Sales Bulletin

The Furblo Institute of Mechanical Heating and Air Conditioning, Hermansville, Michigan, is distributing Sales Bulletin No. 16, containing sales hints on getting closer to the order. The bulletin is full of meaty ideas for the dealer. I. W. Rowell is director.

◆

294—Air Cooling With Well-Water

Crane Co., 836 South Michigan Avenue, Chicago is distributing a leaflet on air cooling with well-water. They claim that with their well-water cooling systems, final temperature in homes or stores may be reduced to within 5 degrees of the well-water temperature and the lower indoor humidity maintained is an additional cooling factor.

Through licensed heating and plumbing contractors, the Crane Company sells these systems on convenient terms through the Crane Finance Plan. The operating cost of well-water cooling systems, they say, for the average home is extremely low—under $20 for the entire summer season.

The Crane well-water cooling system is composed of a Crane shallow or deep-well pump, filters, blower or fan, cooling coils and the necessary housing, piping and controls.

The systems are fully described and illustrated by photographs and drawings.

◆

295—Rival Strap Hanger Leaflet

Berger Bros. Co., 229-237 Arch St., Philadelphia, is distributing a small leaflet, picturing and describing the Rival Strap Hanger for single bead and double bead gutter. The makers say that the Rival Strap Hanger is in one piece and can not spread—that its truss shape makes it rigid and unyielding. No complicated instructions are needed to apply it—installation is assured with a minimum of labor.

◆

296—Ryerson Data Book

Joseph T. Ryerson & Sons, Inc., 16th & Rockwell Sts., Chicago, is distributing their general data book of 192 pages, 4½x8½ in. and thoroughly indexed.

Ryerson Steel-Service includes more than 10,000 sizes and kinds of steel and allied products in stock for immediate shipment. Experienced workers bend, flange, weld, punch and form all types of assemblies to exact specifications and an engineering service is rendered to assist in securing the best design and right steel or to assist on any production problems. Ten plants—Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, New York, Philadelphia and Boston—are maintained.

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 89.

297—Re-Humidifying Indoor Air

Monmouth Products Company, Research Department, 231 East 131st Street, Cleveland, Ohio, has just published a new 16-page, 8½ by 11, catalog entitled "The Science of Re-Humidifying Indoor Air." Copies are offered free to heating contractors, appliance manufacturers, engineers and salesmen.

The book contains complete and authoritative data on the fundamentals of indoor humidification in concise and readily usable form. The facts about humidifying are given in pictorial chart form. The authors claim that the charts (in two colors—red and black) give such a clear picture that the reader can master the subject of humidity in from one to two hours, and credit is given to the University of Illinois Heating Research Department for invaluable data obtained from their published bulletins, on which the charts are largely based.

The first chart shows the moisture content of air at various temperatures, and the average outdoor humidity; the second the ABC of indoor humidifying at prevailing outdoor temperature; the third the unsatisfactory results given by humidifiers at prevailing outdoor temperatures; the fourth the unsatisfactory results given by humidistat control at prevailing outdoor temperature; the fifth pictures the ideal results claimed by Automatic June control at prevailing outdoor temperatures; and the sixth shows window condensation and indoor humidity limits at prevailing outdoor temperatures for single glass, double glass and double windows.

◆

298—Hendrick Perforated Metal Grilles

Hendrick Manufacturing Company, Carbondale, Pennsylvania, is distributing a 68-page 7¾x10½ inch catalog, illustrating and describing their various grilles with dimension charts and tables of weights of sheet metals. Many interesting and attractive faces are shown.

◆

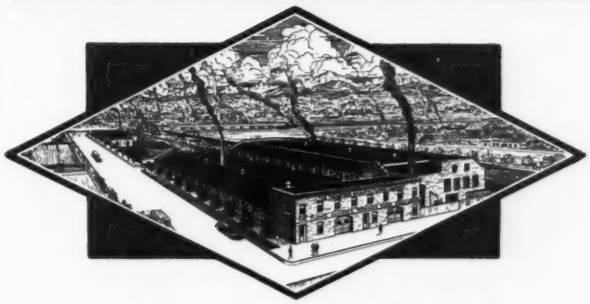
299—Ventilating Equipment Leaflet

A new data and price sheet for Autovent propeller fans and ventilating products is announced by Autovent Fan and Blower Company, Chicago, Illinois. The new price sheet, know as F-250, was effective December 2nd, 1935. The folder shows the company's propeller type ventilating fan with information on correct methods for figuring ventilation and air changes required and detailed information on the application and construction of the ventilating unit. Tables of specifications for all types of fans manufactured, including motors, shipping weight, capacities, and sizes are presented. The leaflet also shows fan housings, fan guards, automatic louvres, cabinet ventilators, portable ventilators, attic ventilating fan, furnace booster fan, and pulley driven fans.

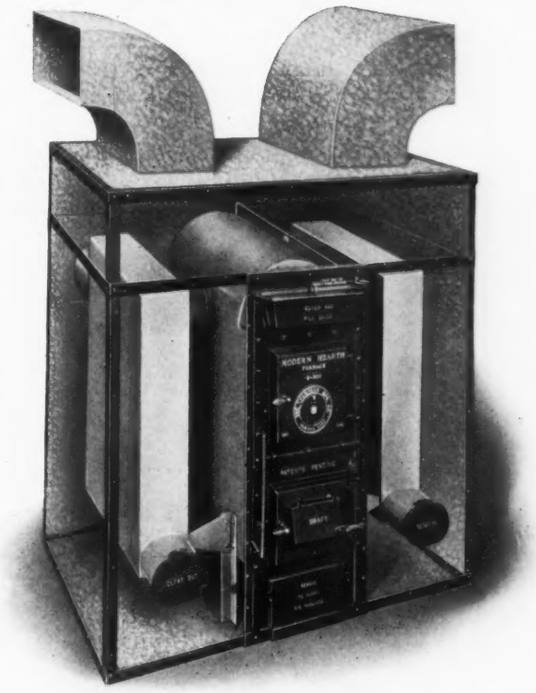
◆

300—Dailaire Pacemaker

Dail Steel Products Company, Lansing, Michigan, has just published Dailaire Pacemaker—Models 100 and 0-100—a four-page, 8½x11 folder. This unit features the counterflow air delivery principle. The Pacemaker unit was designed and styled to fit the need of a six to eight-room house, and is available for oil, gas or coal. The compact housing contains the new steel furnace, blower in bonnet, radiator in return air stream, filter at flow level. Motor occupies an individual stand outside the casing.



Today's Most Modern Furnace the Result of Over Half a Century's Experience!



A phantom view of the MODERN HEARTH S-800 adequate for the average eight or nine-room home.

SEE THE DIFFERENCE! MODERN HEARTH all-steel Furnaces are square in design throughout—NOT an old fashioned round job in a modern casing. Its square interior design gives a longer fire travel and greater heating surfaces, which lowers the fuel cost by increasing efficiencies whether coal, gas or oil is burned.

Investigate the MODERN HEARTH Furnace with the TWO-FUEL FEATURE that changes from coal to gas and back again by simply moving a lever!

Modern Hearth Furnaces

Manufactured by

THE THOMPSON MFG. CO.

30TH & LARIMER STREETS DENVER, COLO.

Nat'l Warm Air

(*Continued from page 22*)

occupancy; or it may be zoned according to sun exposure.

Mr. Kingsland showed numerous slides of typical houses to explain how zone control offers more satisfactory heating comfort than the use of a single thermostat.

E. B. Lau of the Lau Blower Co., Dayton, speaking on the sale of forced air heating declared that—"Our industry must make certain that the public understands there is a difference between winter, summer and year 'round air conditioning, and in the jobs we recommend and sell, we should emphasize just how much air conditioning we propose to furnish. Generally speaking, the public has considered air-conditioning from the standpoint of summer comfort cooling; therefore it is up to our industry to emphasize that winter air conditioning is vastly more important because of the extended heating season as compared to the cooling season in most parts of the country. It is true that in large portions of the country summer cooling is highly important; in fact, it may be more important than winter heating, but generally speaking, winter air conditioning is the first step toward complete air conditioning after which the public can add progressively as many additional steps to complete year-'round air conditioning as the purchaser's pocketbook will stand.

Cooling Progress

"In spite of the fact that our industry has tended to believe that cooling is secondary in importance, we should remember that where cooling systems are involved, the home owner will use cooling to a greater extent than we oftentimes consider. For instance, with a cooling system in a residence, such a system will oftentimes be operated for a few hours during a day when without a system a little thought would be given to inside conditions. The average owner has very little idea as to the cost of cooling, and I suggest that approximately one-half ton of cooling per room is not out of line with present requirements. During the heating season in most parts of the country about 210 days per year can be used for winter air conditioning. The combination of winter air conditioning and summer ventilation (the system which we commonly call attic or night air cooling), is practicable, but the industry should remember that with such combination systems, we must design for low winter velocities and high summer velocities with greatly increased friction in the ducts if we propose to do summer ventilation by means of the winter heating blower. Our own experience indicates that anything less than 20 air changes per hour will not produce the comfort condition which the home owner anticipates, and recently I was astonished to find that in the vicinity of Birmingham, Alabama, the installers are designing for sixty air changes per hour for summer ventilation. Regardless of whether we design for twenty or sixty air changes, we must install a basement or attic blower which will move this amount of air, and the average furnace blower as installed today for winter heating will not produce this large number of air changes.

"Price still remains the stumbling block to the proper installation of such combination systems. The only thing the purchaser can see is the blower box in the basement or the blower fan in the attic. He can not appreciate why such a piece of apparatus should cost practically as much as his original heating apparatus. It is up to the industry to explain to the home owner that when summer ventilation is installed it is necessary to build a new bonnet, install new pipe, add a larger blower with necessary baffles, to hand clean all the existing pipe, register boxes and registers, as well as the return air runs, all of which adds materially to the installed price."

Summer Cooling

Addressing the convention on the subject "Research in Summer Cool-

The Golf Tournament

	Winner	Trophy
Blind Bogey	E. D. Lane	President's Trophy (Stormguide)
1st Low Net 18 Holes	D. B. Poling	National Sheet Metal Contractors Trophy (Plaque)
2nd Low Net 18 Holes	W. E. Bogen	A.S.H. & V.E. Trophy (A.S.H.V.E. Guide)
3rd Low Net 18 Holes	L. E. Heasley	Managing Dir. Trophy (Barometer)
High Net 18 Holes	Tom Byrd	Neckties
First Low Gross 18 Holes	Jack Stowell	Sheet Metal Worker Trophy (Handbag)
2nd Low Gross 18 Holes	L. R. Taylor	Past Pres. Trophy (Rolls Razor)
High Gross 18 Holes	W. E. Richardson	Special Tommy Richardson Prize
Low Net 1st 9 Holes, ½ Hand.	S. D. Mizell	Necktie
Low Net 2nd 9 Holes, ½ Hand.	Art Johnson	Necktie
Even Holes ½ Handicap	B. E. Watson	American Artisan Trophy (Cocktail Shaker)
Odd Holes ½ Handicap	F. E. Snowberg	Minneapolis-Honeywell (Toilet Set)
Low Total Score, Par 3 Holes	C. A. Olson	First Vice-Pres. Trophy (Electric Clock)
Low Total Score, Par 5 Holes	Frank Meyer	Independent Register Trophy (Radio)
Most Number 5's	P. S. Miller	Armstrong Furnace Co. Trophy (Golf Bag)
Most Number 6's	J. H. Ebbert	Necktie
Most Number 7's	J. F. Day	Necktie
Highest Score on One Hole	J. H. Van Alsburg	Necktie
Least No. of Putts 18 Holes	A. L. Rybolt	R. W. Blanchard Trophy (Airguide)
Highest No. Putts 18 Holes	W. B. Cooper	Necktie
Door Prize	R. P. Wettstein	Necktie
Special Door Prize	Miss L. E. Meisinger	Deshler-Wallick Hotel (Bottle of Champagne

ing," M. K. Fahnestock, of the University of Illinois, reviewed the cooling research conducted in the Research Residence during the years 1932 to 1935 inclusive. During this time, cooling by means of ice, mechanical refrigeration, mechanical cooling units, water from the city mains, and outdoor air at night have been tested. Mr. Fahnestock explained the general method of conducting cooling tests and showed slides of the Research Residence, the layout of rooms, the piping system for winter heating and summer air conditioning, the installation of the attic fan for night air cooling, with additional charts indicating the results obtained by the different methods.

Mr. Fahnestock explained so far as was practicable for all the central cooling systems, the same arrangement of ducts and air distribution was used. He explained that coils were installed in the return air side of the system. These coils were kept cool first by ice water circulated from an ice bunker by a water pump, secondly by direct expansion from a mechanical compressor, and during the summer of 1935 by water introduced from the city mains at a temperature of 58 degrees.

Cooling Costs, Awnings, Night Air Ventilation

Possibly the most interesting part of this very comprehensive discussion was the table of operating data for the central cooling plant, and the seasonal operating costs for central cooling plants. These data showed that using ice as a cooling medium in 1932 there was 62 days during which the temperature exceeded 85 deg.; using mechanical refrigeration in 1934, there were 65 days with temperatures above 85 deg.; and in 1935, using water from the city mains there were 49 days with temperatures above 85 deg. F. The effective temperature maintained during all these three tests ranged from 72 to 75½ deg. F. and the total cost per hour per ton of refrigeration delivered was as follows: With ice, 18.56 cents; with mechanical refrigeration, 5.49 cents; with water from the city mains, 6.61 cents. To mechanical refrigeration and water from the city mains must be added the cost of operating the fan for night air cooling at 0.27 cents for 1934 and 1.37 cents for 1935. These costs were based upon ice at $4.00 a ton, water at 33 cents per 1,000 gal., and electrical power at 3.1 cents per kilowatt hour.

Using the same cost for ice water and power as listed above, the total operating costs for the cooling season using ice as the cooling medium and the night air cooling but without awnings on the windows was $258.67. Quite interesting is the fact that circulating night air and with awnings on the residence, the seasonal cost was $174.56.

Using awnings on the windows for all tests, but without circulating air at night and mechanical refrigeration, the total seasonal cost in 1934 was $75.09. With mechanical refrigeration and awnings on the windows and circulating air at night, the total seasonal cost in 1934 was $62.65. In 1935, using water from the city mains with awnings on the windows and circulating air at night, the total seasonal cost was $36.91.

These interesting figures compiled by the Research Residence will be reproduced shortly to indicate the

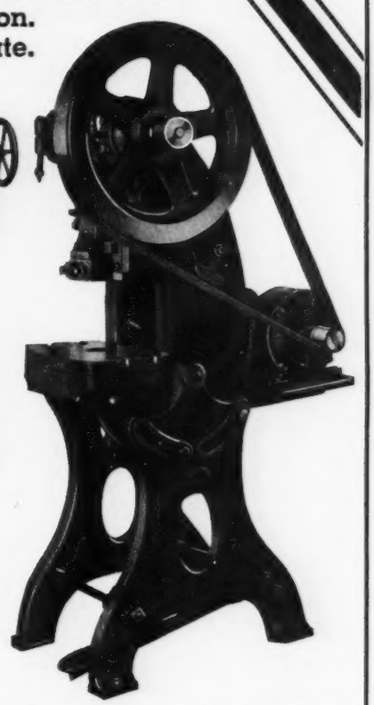
The MARSHALLTOWN Line

PRESSES—Capacities from 10 ton to 70 ton.
SHEARS—Capacities 18 gauge to ½" plate.

No. 18
HAND POWER THROATLESS SHEAR
For irregular cutting or straight splitting of 18 gauge sheets or lighter. Will cut sheets of any dimensions.

No. 116
THROAT SHEAR
Is especially designed for Cutting Inside Circles and Irregular Shapes.

No. 18
MOTOR POWER THROATLESS SHEAR
Complete with ⅛ HP standard motor, self-feeding and easy to operate.



No. 2
PRESS
This ruggedly constructed Press is arranged with proper distribution of weight giving maximum strength and affording ample die space, low operating cost and increased output.

Ask Your Jobber or Write

Marshalltown Manufacturing Co.
MARSHALLTOWN IOWA

comparison of cooling costs as established by the University.

Mechanical Code

Prof. J. D. Hoffman of Purdue University, reporting for the Code Committee of which he is Chairman, announced that a new code for mechanical warm air heating has been under consideration for some time and will be ready for release in a month or two. Prof. Hoffman said that there is no expectation of dropping the Third Edition of the present Mechanical Code as many contractors prefer this method and the Third Edition will be revised from time to time. The new Code is suitable for any type or size of structure and is based upon Btu. terminology.

Advisory Committee

At the Thursday morning research session, F. G. Sedgwick, Committee Chairman of the Research Advisory Committee, explained briefly the 1935 summer cooling test, using city water at 58 deg. and last winter's test on oil burning furnaces. He explained that during 1936-1937 heating season, it is proposed to continue investigations of controls, and it is hoped that a code for rating oil burning furnaces will be established. A tentative code for rating oil burning furnaces will be made and mailed to members shortly.

Design Procedure

Prof. A. P. Kratz, of the University of Illinois, speaking on "A Resume of Our Research Work on Forced Air Heating and Its Practical Applications" outlined a suggested method of design procedure based upon facts established at the Research Residence. Prof. Kratz said that his design method may differ considerably from the practice commonly in vogue, but has been set up by the University as a result of the problems which the University encountered and which the Research Staff believe should be solved before a satisfactory design could be looked for. Briefly stated, this suggested procedure consists of the following steps:

1. Determine heat loss from each room.
2. Locate warm air registers and return grilles.
3. Prepare a duct layout by means of single connecting lines.
4. Determine the equivalent length of ducts to determine the resistance of the duct work.
5. Select the value for bonnet air temperature (suggested somewhere between 100 and 165 deg.)
6. Determine approximate temperature loss for each duct. Prof. Kratz showed a temperature drop chart in which the values are determined at approximately one-half of a degree per foot of duct.
7. Obtain approximate value of register air temperature.
8. Determine required air volume for each room, using proper register temperatures.
9. Determine register size using proper allowable register velocities according to the shape, arrangement and requirements of the room.
10. Prepare a layout which consists of the trunk duct or individual duct system with branches, risers, etc.
11. Determine the total frictional resistance in the duct system, the furnace, filters, fans, coils, etc.

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With the Manufacturers . .

A. F. Frazee Leaves Rudy

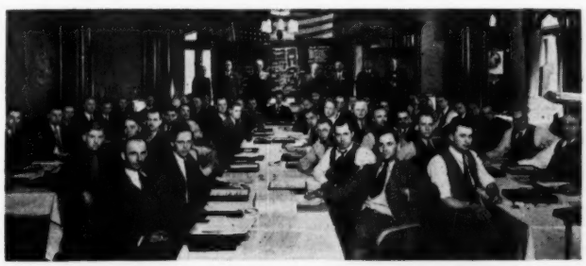
Arthur F. Frazee, 206 Courtland Street, Dowagiac, Michigan, has resigned as vice president and general manager of the Rudy Furnace Company. Mr. Frazee has been affiliated with the Rudy Furnace Company for the past sixteen years. "My plans for the future have as yet taken no definite form other than that I shall take a few weeks vacation," says Mr. Frazee.

◆

Fox Syracuse Engineering School

The photo pictures the sixty jobbers, jobbers' salesmen and heating contractors who attended the Sunbeam Air Conditioning School recently held at Syracuse, New York.

The first two days were applied to engineering problems encountered in calculating and designing an air conditioning system for a typical residence. Building plans and specifications were provided and the students performed



the very practical task of figuring the requirements and laying out the system. The basis for these calculations was the Sunbeam Air Conditioning Engineering Manual, a sixteen-page book developed by The Fox Furnace Company, to simplify the figuring of air conditioning systems.

The third day was devoted to such topics as cooling, ducts, registers, grilles, installations, sales and advertising.

According to Mr. Olsen, President of The Fox Furnace Company, these schools have been very successful. "It has been gratifying to us," he says, "to find so many of our distributors and dealers eager to avail themselves of the opportunity to increase their knowledge of air conditioning.

◆

Two New Distributors

W. L. Blake Co., Portland, Maine, and Hunter & Havens, Bridgeport, Conn., have been added to the list of distributors of Toncan Copper Molybdenum Iron sheets, according to an announcement by N. J. Clarke, vice-president in charge of sales of Republic Steel Corporation, Cleveland, Ohio.

FOR YOUR CONVENIENCE

American Artisan, 6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturer to send me more information about the equipment mentioned under the following reference numbers in "New Products" and "New Literature." (Check numbers in which you are interested):

62	63	64	65	66
67	68	69	70	71
72	73	74		
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297	298	299	300	

Name ..... **Title**.....

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make an *extra* profit on every furnace with FIRELINE

Repeat orders from these typical Ohio furnace men indicate:

(Dayton) **$ 890.00** *extra* profit

(Sandusky) **$ 1,100.00** *extra* profit

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IN LESS THAN A YEAR Fireline has swept the country; is stocked by all leading jobbers; is specified in some localities for all furnaces as prerequisite to a F. H. A. loan, is essential to firepot protection and efficient furnace performance. FIRELINE repairs cracked and broken firepots without new castings. It protects new firepots indefinitely. It increases the capacity of any furnace by raising combustion temperatures. It eliminates *smoke, soot and furnace gas.* It cuts fuel bills as much as 20%. Every home owner you tell about FIRELINE wants it! ! !

$10 PER HOUR PROFIT (above cost of material and labor). You can FIRELINE any furnace in an hour. You can sell FIRELINE jobs where you never sold before for FIRELINE is unequalled as a door opener, as a feeder for all kinds of furnace work. Today it is sell FIRELINE and profit or sell against FIRELINE and miss a lot of business. Before deciding which you'll do *get all the facts.* Send in the coupon for prices, discounts, installation data, description of the FIRELINE sales set-up—circulars, newspaper mats, displays, etc., and a FREE SAMPLE of FIRELINE.

Don't delay . . . shipments prove that furnace men are cashing in on FIRELINE every day.

Comes ready mixed in sealed drums.

Forms 1-piece moulded lining around Firepot

Free Sample Coupon

FIRELINE STOVE & FURNACE LINING CO.
1866-G Kingsbury St., Chicago.
GENTLEMEN: Send full information and FREE SAMPLE.
Name .....
Address .....
City..... State.....

(Copr. 1936, Plibrico Jointless Firebrick Co.)

12. Select the fan and furnace.

Professor Kratz explained as he went along just why this procedure was recommended. He showed by means of charts and drawings some of the instances in which the design calculations of the research staff varied considerably from the actual results obtained when the system was in operation. It was interesting to note that while the overall difference between design and actual operation was very small; actually in some particular phases of procedure, the difference was enormous.

Oil Furnaces

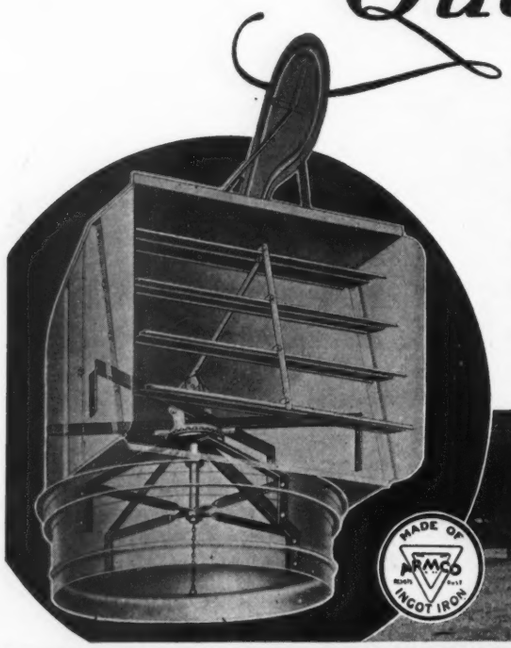
S. Konzo of the University of Illinois, reporting on "Performance of Oil Burning Furnace in Research Residence" gave a description of the Research Residence and the heating system design as we are familiar with it, and briefly outlined how the tests have been run to establish a rating for oil burning furnaces. Some of the tests of particular interest related to the performance of specially designed oil-burning furnaces as compared to conversion burners in cast iron, top radiator furnaces. The tests show that the fuel consumption decreased, operating performance improved, fan power consumption was decreased in the design unit as compared to the conversion system.

Also of interest is the fact that the tests showed the capacity and efficiency of the specially designed oil furnace unit to be better than the conversion unit. Somewhat offsetting the commonly held opinion that CO_2 is a direct criterion of the furnace and burner efficiencies, the tests at the Residence show that a furnace having adequate and effective heating surface may be operated at 9.5 per cent or 11.5 per cent CO_2, without making much difference in the result. The Research staff feels that effective heating surface is of far more importance than the actual CO_2. To bear out this point, Mr. Konzo showed a slide of two units—one a conversion type with average heating surface and the other a specially designed unit with much greater heating surface—in which the CO_2 was varied over a considerable range and in all cases the specially designed furnace with the greater heating surface gave the best overall results.

Of some interest, also, is the fact that the tests disclosed that the firing rate of oil burners should be reduced to the minimum. In other words, if a burner can adequately heat a house on one gallon per hour consumption, it is inefficient to provide a burner with one and a half or two gallons per hour capacity, assuming that shorter firing cycles will mean just as much ultimate economy as the longer firing cycles with less oil consumption. The tests indicate that this does not prove out in practice due to the fact that efficiency losses occur in some of the chemical changes which take place.

Mr. Konzo declared that a code for rating oil furnaces will possibly be submitted for approval shortly, but that the final code is some time in the future. He pointed out that present code ratings based upon Btu capacities (input or output) are meaningless unless the purchaser knows the rate of oil firing, the amount of air being passed over the furnace by the blower, whether the ratings are established at the bonnet or in the flue, etc.

Quality Counts!



Quality TALKS quality—not only for the product itself—but also for YOU, the one that recommends, sells, and installs it.

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Quality counts because it means the elimination of complaints, comebacks and adjustments.

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Make quality count for YOU by recommending and installing the Swartwout Rotary Ventilator. Catalog sent on request.

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Capacity 16 gauge H. R. Steel, speed 15' per minute, as you feed. Universal motor.

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Bench and floor models with capacities up to ¼" boiler plate. Stanley Circular S 44 gives full details on portable and stationary models.

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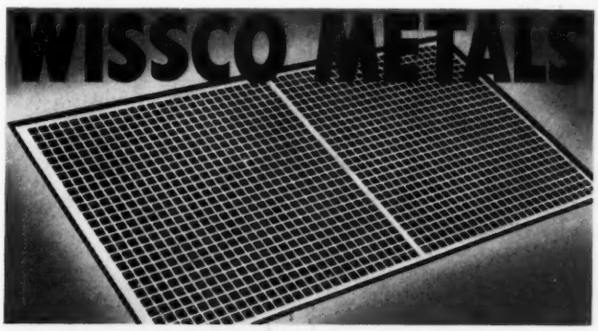

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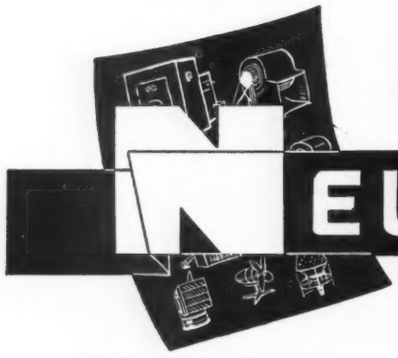


For your convenience a number has been assigned each item. Check the items in which you are interested on the coupon on page 89 and mail to us. Complete information will be forwarded.

● Indicates product not listed in 1936 Directory

△ Indicates product and manufacturer not listed in 1936 Directory

NEW PRODUCTS

62—Circulating Heater

The Perfection Stove Company, Cleveland, Ohio, has restyled the Superfex oil burning heat-directors, combining radiant and circulating heat with the advantage of "directed" heat.

A patented feature of the Heat-Director is a series of adjustable shutters on three sides, making it possible to direct the heat to the floor or in any direction where it may be most needed. When the shutters are completely open, radiating heat is supplied, and with the shutters closed the heat is circulated.

There are three sizes of the Heat-Director. Fuel oil is burned without machinery, wicks, or lighting rings.

The company also announces a Heat Projector with a heating capacity of 102,300 B.t.u. equivalent approximately to heating 10,230 cu. ft. of standard construction to 70 degrees in zero weather. An electric blower is used for forced circulation.

◆

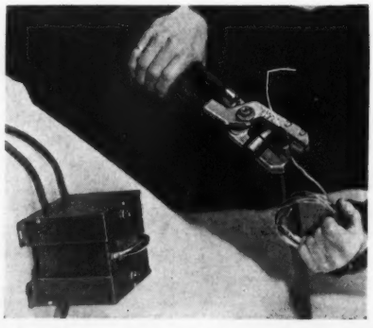
●63—Timing Relay

A timing relay, designed to permit the operation of two or more electrical units, each unit starting at a different time interval, is announced by Edison Electrical Controls Division, Thomas A. Edison, Inc., West Orange, New Jersey. The time interval is provided by a sealed thermal relay which actuates an auxiliary magnetic contactor. For installations (such as two or more compressors in a cooling system) the relay permits each compressor to reach full operating speed before the next compressor starts, thus reducing the load demand on the electric line.

◆

●64—Hot Jaw Pliers

Ideal Commutator Dresser Co., Sycamore, Illinois, has added to its line Thermo-Grip pliers, an electric heating tool which takes the place of an open flame blow torch or burner. When the wire connections are



plugged into any A. C. lighting circuit, current passes through the transformer and rapidly heats the jaws to a white-hot temperature.

The tool is used for small soldering and heating jobs.

These pliers have renewable carbon jaws, insulated fibre handles, and a "Hi-Lo" heat control and "Off-On" switch. Current is only consumed when pliers are being used.

The entire unit is portable, weighing 14 pounds, is said to be safe, shockproof and sturdily built.

◆

65—Trane Airite

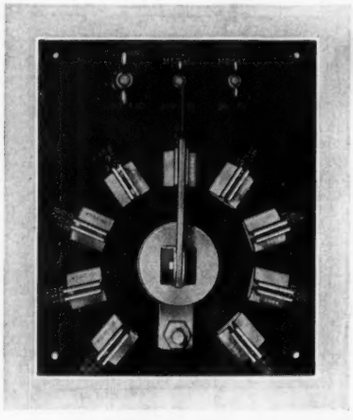
The Trane Company, La Crosse, Wisconsin, has just placed on the market, the Airite, a complete year round air conditioner of the direct-fired, oil burning type. Inside the

modern casing is the steel furnace with a new type heat exchanger, a cascade type humidifier, centrifugal blower and space for cooling coils. The unit supplies an abundance of clean, humidified air of comfortable temperature. In the winter, automatically controlled heat is provided, with summer cooling accomplished by standard Trane cooling coils using either cold water or direct expansion refrigerants. Smart cabinet design and an attractive two-toned finish make it suitable for installation in the recreation room.

◆

66—Rotary Knife Switch Control

Miller Electric Mfg. Co., 1134 West Wisconsin Avenue, Appleton, Wisconsin, announces a rotary knife switch control, which brings all amperage changes under one switch arrangement, thus preventing the confusion and complications of the various controls used in connection with A.C. welders. This switch is distinctly marked in amperes so the operator knows exactly what amperage he is



getting under any setting.

The company also announces that the entire sales of the Miller Electric Arc Welder will be handled by Giant Grip Mfg. Co., Oshkosh, Wisconsin.

◆

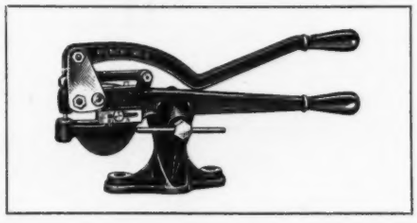
●67—New Fan Attachment

To complete their line of Ozone generators, the Electroaire Corporation, 1487 W. Congress street, Chicago, Illinois, has developed a new, inexpensive, ozone-generating unit which may be installed on any fan mounted on a standard.

This unit, called Electroaire Fanozone, is said to remove odors and impurities, freshen and revitalize the air; and then circulate the freshened, sweetened air.

WHITNEY No. 8 PUNCH

In the W. A. Whitney line of Hand Lever Punches you will find a portable hand lever tool suitable for every requirement. They are made in ten sizes and types, ranging in size from the Tinners No. 4 Punch, which punches ¼-in. hole through 16 gauge iron to the No. 92 Punch, capable of punching a 2-inch hole through ⅛-in. stock. Each tool has its special field of work as recorded in our latest catalog.

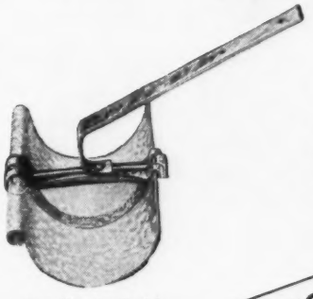


The Whitney No. 8 Punch has a capacity of ¼-in. hole through ⅛-in. iron. Length 18½-in. Weight 7½-lb. Depth of throat 2-in. Stock sizes $\frac{7}{16}$-in. to $\frac{7}{16}$-in. by $\frac{1}{64}$-in. Complete tool includes three punches and three dies of specified sizes and die adjusting key.

WRITE FOR CATALOG G

W. A. WHITNEY MFG. CO.
636 RACE ST. ROCKFORD, ILL.

-BB- QUALITY



"THE RIVAL"
STRAP HANGER
Eaves Trough
Conductor Pipe
Conductor Fasteners
Mitres

For Single Bead

BUILD UP A REPUTATION WITH -BB- PRODUCTS
CARRIED BY LEADING JOBBERS EVERYWHERE

For Double Bead

End Pieces and Caps
Conductor Heads
Ornamental Straps
Ventilators, etc.
Write for Literature

BERGER BROTHERS CO.
229-237 ARCH ST. PHILADELPHIA, PA.

HOW TO SELL FURNACES and REPAIRS

The only proved, positive and sure way to sell furnaces and repairs is to sell first

TORNADO Furnace Cleaning Service

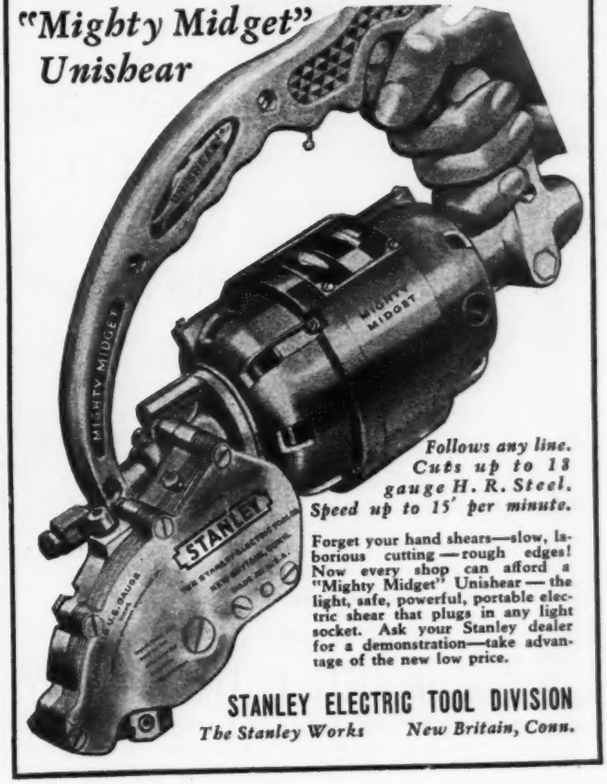
Furnace cleaning is easy to sell because it pays for itself many times over through fuel savings. Besides the profit you make on the cleaning job itself, you have still greater opportunity because you get into the basement where it is easy to convince the owner that he needs a new furnace or repairs.

Hundreds of dealers are now building business with the TORNADO—the most powerful and complete furnace and boiler cleaner built. Leads the field! Low price—easy payments! Write for complete information on a real money-maker!

BREUER ELECTRIC MFG. CO.
865 Blackhawk St., Chicago, Ill.

NEW LOW PRICE

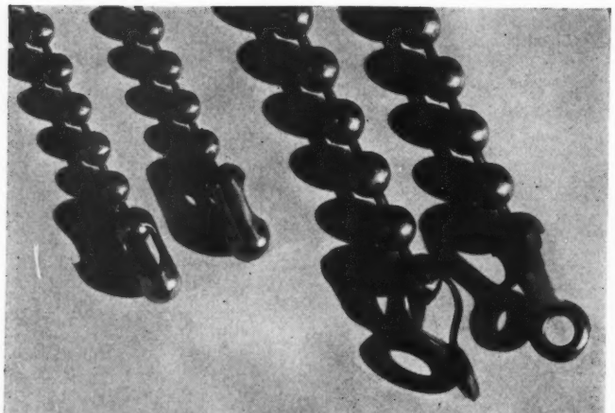
"Mighty Midget" Unishear



Follows any line. Cuts up to 13 gauge H. R. Steel. Speed up to 15' per minute.

Forget your hand shears—slow, laborious cutting—rough edges! Now every shop can afford a "Mighty Midget" Unishear—the light, safe, powerful, portable electric shear that plugs in any light socket. Ask your Stanley dealer for a demonstration—take advantage of the new low price.

STANLEY ELECTRIC TOOL DIVISION
The Stanley Works *New Britain, Conn.*

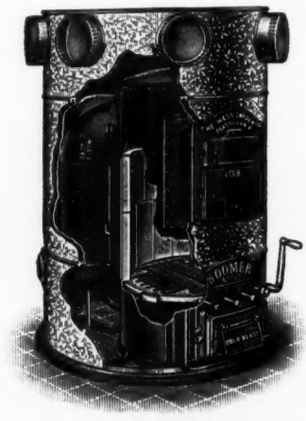


BEAD CHAIN*

This non-kinkable, smooth running chain, of swiveled metal beads, improves every job —in appearance and service. It is ideal for ventilator, skylight, heat control and other regulators. In standard sizes, metals and finishes, with couplings and pendants for many uses. Ask your jobber.

•

THE BEAD CHAIN MANUFACTURING CO.
*TRADE MARK REG. U. S. PAT. OFF. BRIDGEPORT, CONN.



Boomer Boiler Plate Furnaces

Also made with duplex grates and upright shaker.

Have been successfully made for 23 years. Where introduced have given satisfactory service. The fire pot liners are the best we can buy and we know of several Boomers that still have the original liners in, which are 23 years old. We have been making cast iron Boomers for 50 years.

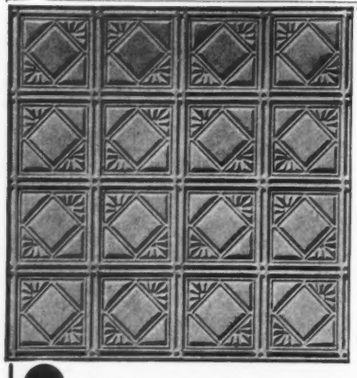
If you are interested in selling a strictly high grade furnace, ask for prices and agency.

Nothing but the best of material enters into the making of Boomers.

When repairs are needed, avoid risk of dissatisfaction by ordering direct from the original patterns. Prices are low.

We sell to legitimate dealers only.

THE HESS-SNYDER CO., MFRS.
Massillon, Ohio



CANTON STEEL CEILINGS

"LEND THE MODERN TOUCH"

. . . and in addition protect the property from danger of fire and falling ceilings. A CANTON Steel Ceiling installation is permanent and safe.

There are plenty of prospective customers seriously considering remodeling and modernizing their stores, restaurants, etc. Why not get your share of what they will spend? Show them how a CANTON Steel Ceiling will lend "the modern touch," give safe fire protection and last for years . . . and you've got a sale.

Go after those jobs now!! And be sure you specify and install a genuine CANTON Steel Ceiling.

Write now for literature.

Sold through all leading Sheet Metal jobbers.

CANTON STEEL CEILING COMPANY
2280 WINFIELD WAY, S. E., CANTON, OHIO
Warehouse Service: 497 West St., New York City, and Canton, Ohio

TRY A GRAND RAPIDS FURNACE CLEANER

OUR FREE TRIAL OFFER — WITH NO STRINGS ATTACHED

ALLOWS YOU TO SEE FOR YOURSELF.

This equipment is built especially for the use of the heating man. It is strictly a finished product. Is powerful—portable and easy to operate. These units have proven themselves in the field for years. We often hear "Everyone who has a Grand Rapids Furnace Cleaner likes it." Our manual "A Plan to Increase Your Sales" is not an armchair theory but the outcome of successful experience.

CONVENIENT TERMS

Our large volume of sales enables us to offer our attractive low price.

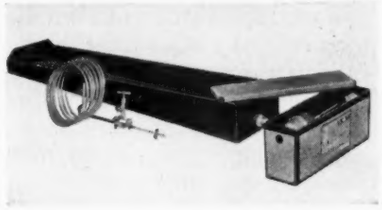
Write for details.

GRAND RAPIDS FURNACE CLEANER COMPANY
Grand Rapids, Michigan

New Products . . . . . .

68—Humidifier

The Vik-Air humidifier recently announced is of two-unit design. The evaporator pan goes through any 8-inch or larger opening, making it unnecessary to cut the furnace casing. The float chamber which is separate from the evaporating chamber and is joined to it through a pipe connection



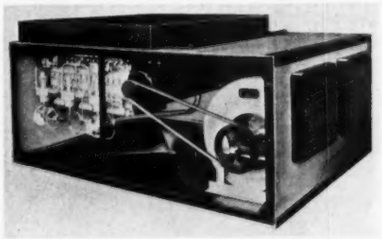
is completely outside the furnace. The valve parts are never in contact with hot evaporating water. The valve opens free and shuts tight, as the float is always in still water. Adjustments are made easily, outside the furnace while the Humidifier is still in operation. Ten feet of flexible copper tubing and a combination saddle connector and shut off valve which easily taps the water supply are furnished.

◆

69—Cooling

Sixty-three units, designed to meet every need from individual room conditioning to large theater and auditorium installations, make up the complete Kelvinator air conditioning line of 1935, just announced. The new equipment is made up of units which can be installed in various combinations to provide the best results at a minimum expense.

Seven self-contained cabinet types of air conditioning units for offices, small shops and residence rooms, are included in the new Kelvinator line. Under average conditions these units are suitable for offices and rooms ranging from 160 to 440 square feet in area, with average ceilings ten feet in height. There are also



seven floor type cabinet models designed for use when the condensing unit can be located at some remote spot.

There are also four suspended type units, equipped with temperature control.

Fifteen evaporator coils for duct installation range in capacity from one to twenty tons. There are nine air cooled and thirteen water cooled condensing units with capacities ranging from one-third to twenty horsepower.

◆

70—Inclinable Press

Niagara Machine and Tool Works announces a new Master Series "A" inclinable press designed for use in manufacturing light metal stampings such as used in the jewelry, automotive, aviation, electrical, toy and other industries requiring small parts.

This A-1-¼ Press follows the improved design of the larger presses in the Niagara Master Series Line. It is equipped with the new Niagara fourteen point engagement sleeve clutch. Flywheel and throwout spindle are mounted on anti-friction bearings. Press is equipped with an inclining device which cuts handling time, by allowing material to drop through automatically to the rear of press after each stroke.

◆

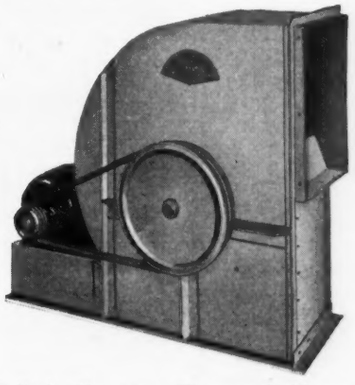
71—Air Circulators

Rex-Airate Air Circulators — 1936 models—have been announced by Air Controls, Inc., 1933 West 114th St., Cleveland, Ohio. There are floor models, ceiling suspended models and an attic ventilator type in two sizes. Descriptive folders are available. Floor circulators have capacities of 5,500, 6,000 and 7,000 c. f. m. Suspended models have 5,500 and 6,000 c. f. m. capacity. The housed attic exhauster has capacities of 6,000 and 10,000 c. f. m. All models employ a propeller type, four bladed fan, 1,750 R. P. M. motor, and belt drive.

◆

72—Autovent Blower

Autovent Fan & Blower Co., 1805 North Kostner Avenue, Chicago, Illinois, announces the new Autovent "V" Belt Drive Unit Blower, illustrated and described on page four of

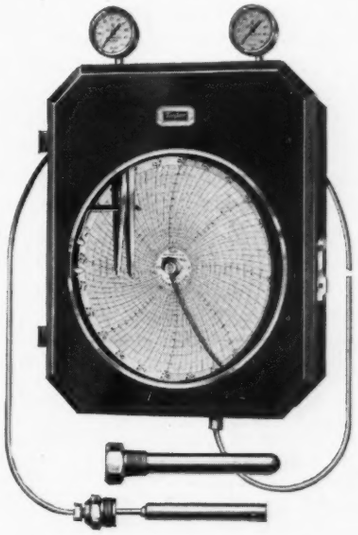


Bulletin No. 300. These unit blowers can be equipped with standard motors operating at 1,750 r.p.m.

The makers say this unit blower is compact, efficient and flexible, and can be used for all applications ordinarily direct connected with the increased efficiency of standard motors.

73—Thermospeed

Taylor Instrument Companies, Rochester, N. Y., claim to have perfected a separable well tube system, known

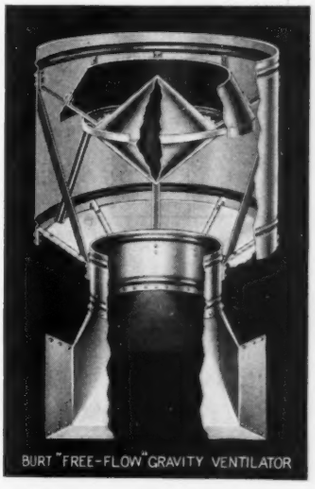


as the "Thermospeed," having a speed response closely approaching that of their extremely fast bare bulb tube systems. Laboratory and field tests indicate that the response due to this new construction is approximately six times faster than the average separable well tube system now in service; and almost twice as fast as separable well thermocouples.

◆

74—Burt Ventilator

The Burt Manufacturing Company, Akron, Ohio, announces a super-capacity stationary ventilator, designed on a new principle. The discharge from the ventilator is vertically upward, op-



posed to the usual type of construction in which a great part of the discharge is beneath the windband. There are no internal louvers. Materials are prime open hearth galvanized steel, copper bearing steel, or any other specified special metal.

This ventilator is said to eliminate condensation of moisture on the roof directly below the ventilator.

Social Security

(*Continued from page* 19)

cise taxes."

To illustrate the workings of this so-called Old-Age Benefit, we shall use a case of a young man, 25 years of age on January 1, 1937, engaged in a "covered occupation" and earning $100.00 per month for each and every month for the forty years ended December 31, 1976. On January 1, 1977, our young man becomes 65 years of age, and, if Congress has not changed its mind, the case will be as follows:

Calendar Years	Rate	Wages at $1200 per year	Taxes Paid Employee	Taxes Paid Employer	Total Taxes Pd.
1937-1938-1939	1 %	$3,600.00	$ 36.00	$ 36.00	$ 72.00
1940-1941-1942	1½%	3,600.00	54.00	54.00	108.00
1943-1944-1945	2 %	3,600.00	72.00	72.00	144.00
1946-1947-1948	2½%	3,600.00	90.00	90.00	180.00
1949 to 1976	3 %	33,600.00	1,008.00	1,008.00	2,016.00
Total Wages Earned		$48,000.00			
Total Taxes Paid by Employee			$1,260.00		
Total Taxes Paid by Employer				$1,260.00	
Total Taxes Paid (Employee and Employer)					$2,520.00

Now that our young man has attained the age of 65 years he can, if he ceases all regular employment, look for a monthly pension check from Washington, for $51.25 for the few remaining years of his life. This pension is computed as follows:

First $3,000 @ ½ of 1%...$15.00
Next $42,000 @ 1/12 of 1% 35.00
Next $3,000 @ 1/24 of 1%. 1.25

Total monthly pension.....$51.25

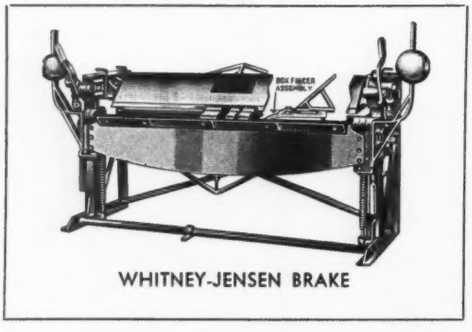
But, notwithstanding the fact that there has been paid, by employee and employer $2,520.00 in premiums during the 40 years, the employee gets no pension if in any month after attaining the age of 65 he receives wages for regular employment for any part of the month.

Another point to be considered is that there is no contract obligation of the Federal Government to pay this or any pension. If the employee paid his premium to an Insurance Company, he would have a legally enforceably contract whereby the Insurance Company would be legally obligated to live up to the terms of the contract. Not so in the case of the Federal Government.

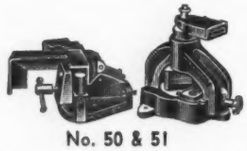
As to probable method of Collection of these taxes, which becomes effective January 1, 1937, we quote:

"Sec. 802. (Deduction of Tax from Wages) (a) The tax imposed by section 801 shall be collected by the employer of the taxpayer, by deducting the amount of the tax from the wages as and when paid. Every employer required so to deduct the tax is hereby made liable for the payment of such tax, and is hereby indemnified against the claims and demands of any person for the amount of any such payment made by such employer.

"(b) (Adjustments) If more or less than the correct amount of tax imposed by section 801 is paid with respect to any wage payment, then, under regulations made under this title, proper adjustments, with respect both to the tax and the amount to be deducted, shall be made, without interest, in connection with subsequent wage payments to the same individual by the same employer."



WHITNEY-JENSEN BRAKE



No. 50 & 51
Angle Iron Mitre & Bender

No. 20 Ball Bearing Punch

No. 12 Ball Bearing Punch

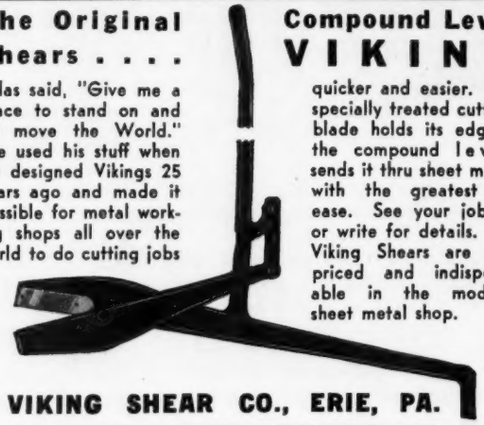
The complete line of Whitney Ball Bearing Punches, Shears, Angle Iron Machinery and Bending Brakes is described, with full information and prices, in new handy catalogue. Write for your copy today.

WHITNEY METAL TOOL CO.
91 Forbes St. Rockford, Ill.

KEEP OLD MAN WINTER ON THE RUN
XX TH CENTURY HEATING & VENTILATING CO.
AKRON, OHIO

The Original Shears . . . .

Atlas said, "Give me a place to stand on and I'll move the World." We used his stuff when we designed Vikings 25 years ago and made it possible for metal working shops all over the world to do cutting jobs



Compound Lever VIKING

quicker and easier. The specially treated cutting blade holds its edge—the compound lever sends it thru sheet metal with the greatest of ease. See your jobber or write for details. Viking Shears are low priced and indispensable in the modern sheet metal shop.

VIKING SHEAR CO., ERIE, PA.

A Complete Line of Furnaces Means . . . . . • BIGGER PROFITS

Here is a complete line of cast iron or steel furnaces, either gravity or forced air types that give you a complete range of styles, and priced so that you can meet all competition. When you handle the Liberty Line you can quote on all installations regardless of size or type of firing, giving you larger volume of sales which means Bigger Profits.

HEATING FRONT RANK SYSTEMS

The FRONT RANK gravity type warm air furnace is the result of 45 years of knowing how to build furnaces with high efficiency and economy. Heavily constructed of high quality steel, rigidly riveted and welded with tubular type radiator. The FRONT RANK Crescent is also of steel construction but is equipped with crescent type radiator to give higher heat radiation. The new FRONT RANK DeLuxe is the last word in forced type warm air conditioners. Entirely automatic with balanced humidifying and temperature controls it meets the demand for the most modern dwellings. It can be equipped with oil or gas burner, automatic stoker or can be hand fired.

MELLOW WARM AIR FURNACE

The Mellow warm air furnaces are America's Perfect Heating units. They are made of solid cast construction and are designed for high efficiency and long life. They are manufactured in gravity type, as well as in the more advanced forced air types that condition air. They, like the DeLuxe Front Ranks, have automatic humidity and temperature controls and can be equipped with gas or oil burners, automatic stokers or can be hand fired.

Distributors and Dealers

Here is a line you should investigate. The Furnace season is at its peak right now so you better write for complete information.

LIBERTY FOUNDRY CO.
St. Louis, Mo.

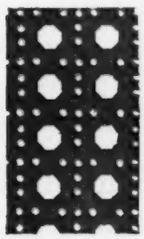
ELIMINATE COMPLAINTS *with* Nu DRY

When you install or repair a furnace the surest way to prevent service calls and complaints is to cement the joints with Nu DRY. It comes to you in dry form . . . takes less material to set a furnace . . . DOES NOT CRACK OR POWDER WHEN FURNACE IS FIRED IMMEDIATELY AFTER APPLIED . . . will not shrink . . . keeps joints tight at all times . . . will withstand high temperatures . . . and eliminates material losses for it does not harden in containers.

Write today for literature.

PYROLITE PRODUCTS CO.
Refractory Engineers
1221-31 West 74th St. Cleveland, Ohio

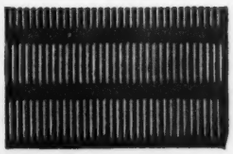
PERFORATED METALS



Screens for Grains, Minerals, Food Products or any material to be graded or screened.

Safety Guard Accessories, including perforated sheets, angles, bands, etc.

Architectural Grilles in many designs. Special patterns and sizes to suit your individual requirements.



Stainless Steel—Brass—Bronze—Copper—Monel—Aluminum—Zinc—or any other metal or sheet material perforated as wanted.

The Harrington & King PERFORATING CO.

5649 Fillmore St., Chicago, Ill. New York Office, 114 Liberty St.

THE SURE FIRE WAY TO SELL A FURNACE

Don't try to.

Instead, sell cleanings; they are easy. They sell on their own merits—better heat—less fuel—a cleaner home. Cleaning pays you a handsome profit.

Your cleanings will automatically bring you hundreds of contacts for new plants—resets—firepots—heat controls. Most of them easily closed—and at non-competitive prices—you will find work uncovered by cleaning will average $10.00 or better PER CLEANING—in addition to the cleaning fee.

——————— USE THIS COUPON ———————

The National Super Service Company,
1944 North 13th St.,
Toledo, Ohio.

Send your Plan Book without cost and tell me about your free trial plan on the NEW HIGH-QUALITY LOW-PRICED RED STREAK CLEANER

Name .....

Street Address .....

City and State .....

"Section 807 (a) (Collection and Payment of Taxes) The taxes imposed by this title shall be collected by the Bureau of Internal Revenue under the direction of the Secretary of the Treasury and shall be paid into the Treasury of the United States as internal revenue collections. If the tax is not paid when due, there shall be added as part of the tax, interest (except in the case of adjustments made in accordance with the provisions of sections 802(b) and 805) at the rate of one-half of 1 per centum per month from the date the tax became due until paid.

"Sec. 807 (b) Method of Collection) Such taxes shall be collected and paid in such manner, at such times, and under such conditions not inconsistent with this title (either by making and filing returns, or by stamps, coupons, tickets, books, or other reasonable devices or methods necessary or helpful in securing a complete and proper collection and payment of the tax or in securing proper identification of the taxpayer), as may be prescribed by the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury."

To sum up this Old-Age Benefit, beginning January 1, 1937, both employers and employees pay taxes to the Federal Government for the apparent purpose of providing an annuity for the employees when they shall have attained the age of 65. After all has been said, there is no contract binding the government to pay the employee anything.

Minneapolis Code

(*Continued from page 79*)

upper grates shall be removed and baffling changed where necessary to secure an unrestricted combustion space.

Section 1607. Used Stokers. Reconditioned: It shall hereafter be unlawful for any person, firm or corporation licensed to install, alter or repair stoker installations within the City of Minneapolis to install any used stoker, or for the Inspector of Buildings to issue any permit authorizing him or them so to do, until said licensee shall have first submitted, with his application for such permit, a copy of the purchase order stating that a used stoker is to be installed and bearing a statement by the purchaser acknowledging that to be the case, together with a statement by said licensee that said stoker has been properly reconditioned and will comply in every way with ordinance requirements for new equipment, as to operation and adjustments.

This completes the publication of the Minneapolis Ordinance. As we have stated several times, this ordinance is, in our estimation, the most comprehensive code we know of. It is our reasoned judgment that any community desiring to operate under a code will do well to adopt the Minneapolis ordinance in its entirety, or, where it is necessary to eliminate certain passages provide for future broadening.

TALK ABOUT THE LONG LIFE OF FURNACE CASTINGS!

Many FAULTLESS installed 40 years ago are still giving fine service.

The durability of a furnace is dependent upon its construction DESIGN as well as upon the quality of the iron.

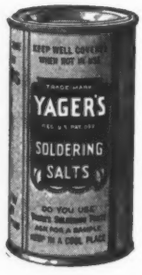
One of the FAULTLESS long life features is the specially constructed gas-tight center joint of our cast radiator which provides for expansion and contraction that so frequently causes cracked or blistered castings.

Years of experience in the design and manufacture of high grade furnaces guarantee the efficiency of FAULTLESS Cast and Steel Heaters.

Our Agency proposition insures protection.

FAULTLESS HEATER CORPORATION
MANUFACTURERS
SUCCESSOR TO THE GRAFF FURNACE CO.
1220 MAIN AVE. CLEVELAND, OHIO

"True to the Name"
FAULTLESS
WARM AIR FURNACES

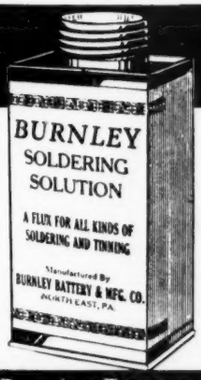


TRADE MARK
YAGER'S
REG. U. S. PATENT OFFICE
SOLDERING SALTS
SAFE ~ FAST EFFICIENT

AT ALL GOOD JOBBERS IN U. S. AND CANADA
ALEX R. BENSON, INC., HUDSON, N. Y.
MANUFACTURING SINCE 1873

IRONSET
the Furnace and Retort Cement
THAT IS
GUARANTEED
Not to crack, bloat, shrink or blister
A Fireline Product—Write for Circular

Fireline Stove & Furnace Lining Co., 1866-G Kingsbury St., Chicago



BURNLEY TRADE MARK

Just a reminder to help you make sure of getting the Soldering Flux your Dad used. Skilled hands reach for Burnley because "it never lets them down." Show us a Sheet Metal Worker who has never used Burnley Soldering Salts or Paste—he gets a generous free sample by return mail. Ask your jobber for Burnley — he carries it—"If he knows his fluxes."

Burnley Battery & Mfg. Co • North East, Pa.
Soldering Paste, Salts, Solution, Stick

RYERSON

IMMEDIATE SHIPMENT FROM STOCK

More than twenty kinds of prime quality sheets are carried in stock. There is a special sheet for every purpose. Also Bars, Angles, Rivets, Bolts, Tools and Metal-Working Machinery.

Write for Journal and Stock List

JOSEPH T. RYERSON & SON INC

CHICAGO DETROIT MILWAUKEE ST. LOUIS JERSEY CITY CINCINNATI BUFFALO CLEVELAND PHILADELPHIA BOSTON

SHEETS

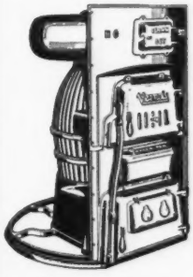
ALL REPAIR PARTS for FURNACES BOILERS STOVES RANGES

A.G. BRAUER SUPPLY COMPANY

316 NO. THIRD ST. • SAINT LOUIS

IN STOCK • READY FOR IMMEDIATE SHIPMENT

The Vernois

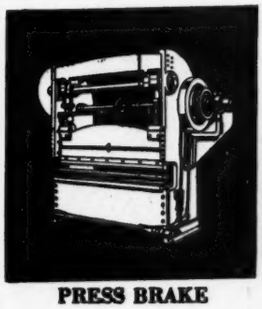


"A BETTER PRODUCT"

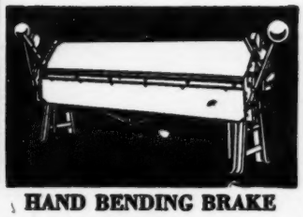
. . . . . a statement with weight behind it, that! The fact that VERNOIS is a better product has been proved over and over again by the countless fine performances of VERNOIS Furnaces. Strongly constructed of processed VERNALLOY Iron, they will outlast ordinary furnaces and perform year after year with no service other than the usual season checkups. Write today for complete information on the VERNOIS. It will repay you.

MT. VERNON FURNACE & MANUFACTURING CO.
MT. VERNON, ILLINOIS

CHICAGO



PRESS BRAKE



HAND BENDING BRAKE

Steel Brakes—Presses—Shears

DREIS & KRUMP MFG. CO.
7404 LOOMIS BLVD. CHICAGO

BLOW HOT

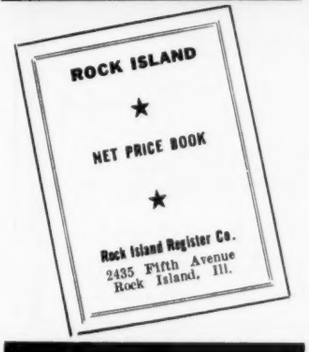
BLOW COLD

ESTABLISHED SINCE 1844

In warm air furnaces in conjunction with forced and conditioned air units . . . insist on Laclede Asbestos FURNACE CEMENT for a permanent and absolutely air and gas-tight joint.

LACLEDE - CHRISTY
411 N. SEVENTH ST. ST. LOUIS, MO.

ESTIMATING BOOK *FREE!*



Net cost of individual runs of warm-air and cold-air pipe for quick estimating. Also net prices on all registers, piping and supplies.

Up-to-the-minute information and prices on blowers and forced-air jobs, with valuable tables.

No obligation. Send coupon today.

ROCK ISLAND REGISTER CO.
Rock Island, Illinois

Mail free estimating book without obligation to

Name .....

Address .....

Cleaning Campaign

(*Continued from page* 16)

service number 1 both men work in the basement.

The third cleaner is being hauled in the mechanics' car, but a trailer is about ready. This small trailer will be hooked to the car and in addition to the cleaner will carry pipe and fittings, tools and necessary equipment to repair or reset a furnace.

Also of interest is the fact that Rummel is keeping the cleaner outdoors. He has rigged up a large bag, as large as his portable cleaner will inflate hard, and declares that the noise of the machine and the bag gives him a good advertising medium. The hose is extended into the house. While he is doing a job the whole neighborhood knows what is going on.

In practically all respects this telephone canvass has proved profitable and a volume producer. Rummel has been unable to secure the services of enough good salesmen to follow up all the calls for inspection and survey produced by the phone calls. This year's cleaning has brought to light a larger percentage of furnaces which require repair and resetting, probably because of the unusually severe winter just past and the tendency of owners during the last three or four winters to "get by" without spending any money.

With more requests for inspection and estimates than the sales force can keep up with, with better prices obtained for cleaning, with repair work increasing, all at a lower per order cost than in any previous campaign, Rummel believes the telephone has proved a highly satisfactory method.

Hyatt Pattern

(*Continued from page* 17)

of like numbers. Through these lines draw the straight and curved lines describing the outline for pattern "H" for the inclined molding.

To develop the pattern for the return miter at the bottom of the raked molding the stretchout line *e-f* is first drawn and the distance found upon profile "C" as well as the distance just below these; *a, b, c, d, e* are stepped off on this line and the usual horizontal measuring lines drawn through these points.

Next, from the above points drop lines allowing them to intersect like numbered measuring lines and through these lines draw the lines describing the pattern "J". Now draw the stretchout line *g-h*, and upon this line step off the distances representing the wash, the lengths of which are to be found from *1* to *8* on the side elevation as was done with the oblique molding. It will be noted, however, that the inclined *2, 3,* in the side elevation view is not extended to the wall line *O-P*. In all cornice molding problems it is necessary to make all measurements of spaces accurately and all bends accurately. A template should be used when shaping the molding, and no change whatever in the shape should ever be allowed.

THROUGH three generations distinguished visitors to Philadelphia have preferred the comforts of this hotel... its noted cuisine... and the spirit of its service. Rates begin at $3.50.

Air-Conditioned Restaurant

BELLEVUE STRATFORD

One of the few Famous Hotels in America

CLAUDE H. BENNETT, General Manager

Booking Offices in
New York: 11 W. 42nd St., Longacre 5-4500
Pittsburgh: Standard Life Building, Court 1488

By Preference it's DeWITT OPERATED HOTELS • Genuinely Friendly

In Cleveland it's
☐ *The* HOLLENDEN

In Columbus it's
☐ *The* NEIL HOUSE

In Dayton it's
☐ *The* BILTMORE

In Akron it's
☐ *The* MAYFLOWER

In Toledo it's
☐ *The* NEW SECOR

In Savannah (Ga.) it's
☐ *The* GEN'L OGLETHORPE

In Miami Beach it's
☐ *The* FLEETWOOD

DeWitt Operated Hotels
feature
Unusually Comfortable Rooms at Reasonable Rates and the finest of Food and Beverages, Carefully Prepared and Served.

HOTEL LENOX

Comfortable rooms—Attentive service—Memorable meals at fixed, fair prices—Only 5 minutes from the business district yet removed from downtown din—Rates, $1.50 to $3.00 per day per person—Descriptive folder containing map of downtown Buffalo mailed upon request.

140 NORTH ST. NEAR DELAWARE AVE.

CLARENCE A. MINER PRESIDENT

BUFFALO, N. Y.

Automatic Oil Heat for the Volume Market

Simple, sturdy Lochinvar burns No. 1 fuel oil with *no moving parts*. Automatic control—completely reliable—clean—silent. Write for prices on Furnaces, Room Heaters, Water Heaters—for the volume market.

Lochinvar Corporation 11921 Grand River Detroit, Mich.

CLASSIFIED ADVERTISING

4 cents for each word including heading and address. Count seven words for keyed address. Minimum $1.00 for each insertion. One inch $3.00. Cash must accompany order. Copy should reach us eight days in advance of publication date. Display rates for this page will be furnished on request.

SITUATIONS OPEN

WANTED AT ONCE plumber and sheet metal worker, also good plumber on country and village work. Steady work for right party. INDEPENDENT SUPPLY CO., Du Quoin, Illinois.

MAN with following in wholesale and retail sheet steel roofing and kindred lines. State qualifications, experience, salary. P. O. Box 820, Cincinnati, Ohio.

FOR SALE

FOR SALE: Complete course in sheet metal design and pattern drafting. F. CANONICA, 108 So. Arizona, Butte, Mont.

FOR SALE: Going sheet metal and heating business in a live county seat city located in Central Wisconsin, Address Key 376, "American Artisan," 6 No. Michigan Ave., Chicago.

WANTED TO BUY

WANTED—8 ft. foot power squaring shear. Good condition. GEORGE DOLACKI, 3119 West 59th St., Chicago, Ill.

MISCELLANEOUS

SALESMEN: Sell the fastest electric soldering iron on the market, along with your own line. May be brought to red hot heat within 15 seconds. Write for particulars. Maple Valley Mfg. Co., Mapleton, Iowa.

RIBBED WIRE GLASS-13c per SQ. FT.
STOCK SHEETS, CASE LOTS, PLUS BOXING F. O. B. BUFFALO, N. Y. SHIPMENT TO ANY PART OF THE UNITED STATES
QUOTATIONS ON ALL KINDS OF GLASS ON REQUEST
Write for Samples
T. J. ATCHESON GLASS CO.
953 Main St., Dept. A, Buffalo, N. Y.

If you have anything to sell, if you are looking for a "good buy," if you are seeking a connection or if you are looking for a salesman—use the Classified Page of AMERICAN ARTISAN.

FOR SALE

Sheet Metal Machines
New and *Really Rebuilt*

A machine for every use and every machine is ready for use. The largest stock in Chicago. Ask for list.

Complete supplies and tools.

MAPLEWOOD MACHINERY CO., Inc.
Chicago
2634 W. Fullerton Ave. Brunswick 9200
561 W. Washington Blvd. State 1405

? ? ? ? ? ?
HAVE YOU A SHEET METAL PROBLEM: FORMING—BENDING—PUNCHING—SHEARING
WE HAVE A MACHINE FOR EACH OPERATION ON SHEET METAL
Your Inquiries Earnestly Solicited
WARD MACHINERY CO.
SPECIALISTS
MACHINES—TOOLS—SUPPLIES FOR SHEET METALS
562 W. Washington Boulevard
CHICAGO, ILLINOIS

Manufacturers Agents

MANUFACTURERS WANTING ADditional representation often come to us for names of prospective agents now handling other lines in this field on a commission basis in a definite territory. It will pay you to be on record with us so we can refer your name to interested manufacturers. No charge or obligation, of course. It is a service we render free to manufacturers and representative. Just drop a line that you are interested in being on file and we will send you form to fill out. Address American Artisan, 6 N. Michigan Ave., Chicago, Ill.

MISCELLANEOUS

Patents and Trade Marks
Philip V. W. Peck
Barrister Bldg., Washington, D.C.

HOT DIP tinning of milk cans or any manufactured articles requiring tinning, galvanizing or lead coating, is profitable throughout the year. Write for our new circular showing how you can build your own equipment at small cost. Valuable information and instructions furnished free with purchase of necessary supplies. Retinning Mfg. Co., 3021 Greenview, Chicago, Illinois.

JOHNSON'S
NEW HANDY MANUAL
on
HEATING, VENTILATING
MECHANICAL REFRIGERATION
and
AIR CONDITIONING
Just off the press, with 432 pages of practical, condensed information, tables, rules and diagrams.
Price $1.00—Remit with order to
KEENEY PUBLISHING COMPANY
6 N. Michigan Ave., Chicago, Ill.

Use AMERICAN ARTISAN Classified Advertising for quick results. It puts you in direct touch with the buyers and sellers in the warm air heating, sheet metal contracting and air conditioning industry.

"INTERSTATE HAS IT"
"Draw on the MOST COMPLETE STOCK IN AMERICA"

ROLLS—SHEARS—BRAKES—FOLDERS—SPOT WELDERS—PUNCH DRILLS—HAND MACHINE PRESSES—STAKES.

See Us Before-U-Buy
SHEET METAL MACHINERY
We Can Save You Time and Money
Send for BULLETIN No. 835-A

10—Whitney Angle Iron Shears 3"x3"x¼" $35.00 ea.
2—Whitney Angle Iron Shears 2"x2"x¼" $19.50 ea.
10—Whitney Notchers No. 50—2"x2"x¼" $35.00 ea.
BRAKES. Chgo. St. Hand 10'14 ga. $300.00 8'16 ga. $145.00
ROLL 60" 14 ga. Beloit Power Slip $235.00
36" Pexto Groover 20 ga. 95% New $85.00
ROLL 30" x 2" Plain $15.00
10—BRAND NEW No. 620 Pexto Beaders 6" throat 24 ga.
2 pair rolls. Reg. price $25.00. SPECIAL PRICE $17.50 ea.

INTERSTATE MACHINERY CO., INC. 130 S. Clinton St., Chicago

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THERE'S A REASON

. . . why 35,000 sheet metal shops keep these items on hand

Because it means better work and bigger profit sheet metal workers everywhere keep these Parker-Kalon Products on hand, ready for use. On almost every job there's a need for them. Are you taking full advantage of these time-and-labor savers? If you are not familiar with all of them ask your supply house for descriptive folders, or write us.

1. ***To join or make fastenings to sheet metal*** — not over 18 gauge (.050″) thick keep a good supply of the genuine Sheet Metal Screws, made only by Parker-Kalon. They'll do it the simplest, cheapest way . . . just turn them into punched, pierced or drilled holes. They *always* work right . . . genuine Sheet Metal Screws are uniformly good.

2. ***Where fastenings to brick, mortar or concrete are required,*** Hardened Masonry Nails will save you time and do away with expensive devices. Substantial fastenings are made simply by hammering the Masonry Nails into the material, just as you drive a nail into wood. Only in very hard material do you have to drill a small starting hole.

3. ***For secure sheet metal-to-wood fastenings*** — Hardened Screwnails are being widely used. You can drive them right through the sheet metal in most cases. The hardened spiral thread cuts into the metal and worms into the wood, holding like a screw.

4. ***On all work that requires a metal punch*** — you can't beat the famous Hyro No. O.X. for all-around efficiency, convenience and value. It is the strongest punch of its size on the market, and it comes in a sturdy steel case containing a full set of 7 punches and 7 dies . . . all for $5.90 (F.O.B. New York).

5. ***Handles that Screw-on and Stay-on*** a solder iron or file save time, temper, trouble and injuries. Hyro Shur-Grip Solder Iron Handles and File Handles cut a thread on the stem of an iron or a file tang as they are screwed on. Try these handles that cannot loosen or slip off accidentally . . . see why they are so popular.

6. ***Everything for a Damper Control installation*** — comes in the Hyro UNXLD Damper Quadrant or Dial Damper Regulator Sets. No need to waste time in getting together the necessary Damper Bearings, rivets and Parker-Kalon Sheet Metal Screws. These accessories are packed in a single box, with one of the famous Hyro controls which are "standard" among sheet metal workers.

Products of

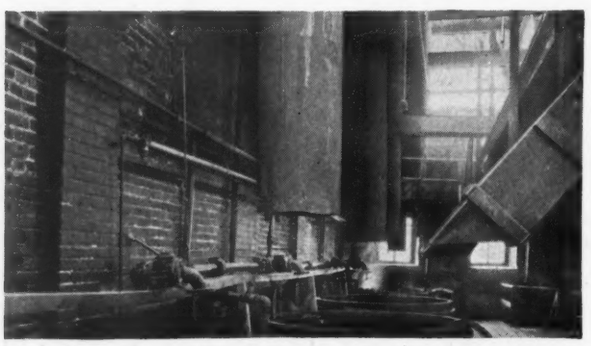
PARKER-KALON CORPORATION

190 Varick Street, New York, N. Y.

Chute the Works...

AND GIVE 'EM AIR

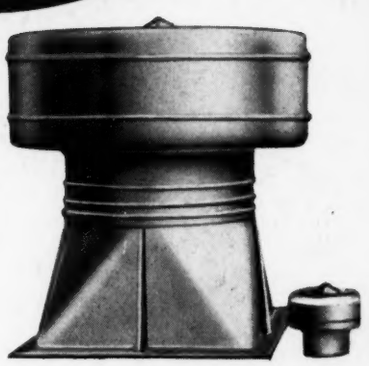
Monel Metal washing machine installation in the plant of the United Linen Supply Co., Los Angeles, Cal. The wet chutes from the washers to the extractors are Monel Metal.

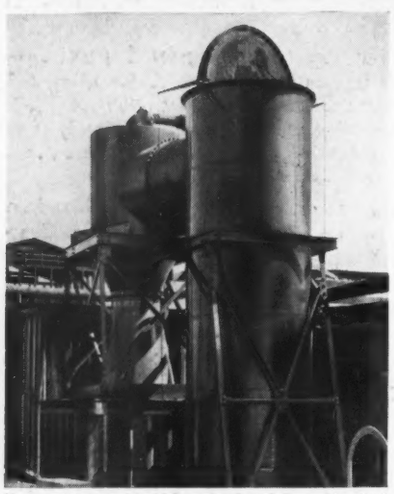


(Above) Monel Metal ventilating exhaust system over an acid tank for cadmium plating, built and installed by J. C. Lauber Co., 504 East La Salle St., South Bend, Indiana.

(Right) Monel Metal ventilator hood manufactured by The Breese Bros. Co., 2347 Reading Road, Cincinnati, Ohio.

(Left) For 18 years these Monel Metal fume ducts have withstood fumes from boiling sulphuric acid at 22-25% concentration in vats used to dissolve cotton from rubber fabrics at the plant of the Dominion Rubber Company, Ltd., Montreal. Somewhat scarred, of course, after 18 years but still good for further service.





Vapors of ferric chloride, at about 225° F., are handled by these Monel Metal stacks over the dryers at Milwaukee's municipal sewage disposal plant. They have been in service for 3 years and seem in as good condition as when installed. Stacks of other material, formerly used, lasted about 14 months.

Profits for you in the size of these jobs... laundries and factories near you need them... let them know YOU fabricate Monel Metal!

THESE pictures tell a story . . . a story of profits for you. . . . The way metal workers got these jobs was simply by telling laundries why Monel Metal is ideal for chutes . . . and telling chemical plants, textile mills, rubber factories, telephone companies, food plants, and laboratories why Monel Metal ventilators give long, trouble-free service.

The reasons are much the same. Monel Metal is absolutely rust-proof. Since it resists corrosion from most acids and alkalies, its surface stays smooth, and it outlives other metals comparable in price.

And while Monel Metal is as strong and tough as steel, it is formed by all regular methods of fabricating, *welding included.*

Most plant managers know these properties . . . all but the last. Go out and *tell* them about Monel Metal's ease of fabrication . . . and that YOU are the Johnny-on-the-spot who fabricates it. You'll land many jobs . . . all of them easy jobs . . . most of them big jobs. Write Inco's engineers for prices and instructions.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 WALL STREET NEW YORK, N. Y.

INCO MONEL METAL

Monel Metal is a registered trade-mark applied to an alloy containing approximately two-thirds Nickel and one-third copper. Monel Metal is mined, smelted, refined, rolled and marketed solely by International Nickel.

MONEL METAL